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IASI UNIVERSITY OF LIFE SCIENCES**

Scientific field: AGRONOMY

# **HABILITATION THESIS**

**Microbes and their role in life sciences**

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## A. ABSTRACT

The habilitation thesis entitled "Microbes and their role in life sciences" presents the synthesis of my scientific and academic work in the field of Agronomy from the period after my PhD thesis at Justus Liebig University in Germany (2010) until now.

The thesis is structured in three sections, being in accordance with the current legislation and the regulations of the USV of Iasi on the organization and conduct of the process of obtaining the habilitation certificate. The sections are organized as follows: the first section presents the scientific, professional, and academic achievements; the second section focuses on the evolution and development plan of the professional career; and the last section contains the bibliographical references used for the thesis.

The results that I have selected to highlight the development of my own scientific career are presented in the first chapter in the form of three research directions, namely: (1) Research on the evaluation of soil microflora; (2) Research on the use of nanoparticles in plant protection and biomaterials in medicine; and (3) Research on the monitoring of fungal aerosols in educational premises. The results are presented in the context of the current state of scientific research in microbiology, highlighting original contributions and their relevance to the field. The thesis includes 48 figures and 11 tables, and for each research direction we have presented the following structure: introduction; material and method; results and discussion; and conclusions

(1) The first research direction presents original studies on the use of bacterial diversity as an indicator for soil pollution and the influence of xenobiotic substances, fertilizers, and different tillage systems on soil microflora. The findings of the first studies showed that the number and diversity of bacteria in soil ecosystems have a complex relationship with the intensity of human intervention and are influenced by environmental, edaphic, and management factors. Findings from studies on the influence of xenobiotic substances (acetochlor, S-metolachlor and chlorsulfuron herbicides) applied at different doses to protect agricultural crops on soil microbiota show that they cause quantitative and qualitative changes depending on their degree of adaptation to the dose of active substance applied. Regarding the influence of fertilizers and different tillage systems on soil microflora, it can be concluded that among the variants analysed, microbial activity was higher in conventionally tilled soils than organic fertilizers were applied and in the no-till system when mineral fertilizers were applied.



(2) The second line of research presents original studies on the synthesis and use of gold-chitosan and carbon nanoparticles against the phytopathogens *Fusarium oxysporum* and *Rhizoctonia solani*, as well as on the production and evaluation of a biomaterial based on keratin and bacterial cellulose as a potential wound dressing for patients with burn wounds. Findings from studies on the use of nanoparticles in plant protection showed that particle size, molecular weight, concentration, and dosage are important factors that should be considered in the future preparation of new fungicide formulations for applications in plant disease management. As for the biomaterial based on bacterial cellulose (*Komagataeibacter xylinus*) and keratin it was determined that they initiated tissue growth with adequate viability. The healing process proceeded much faster compared to the control, demonstrating the important role of cellulose, keratin and stem cells.

(3) The third line of research presents information on the monitoring of fungal aerosols in educational premises in the NE region of Romania. Fungal spores are often reported to be hazardous to human health in the indoor environment due to their potential to cause allergies, respiratory diseases (including asthma) and symptoms of sick building syndrome. *Penicillium*, *Aspergillus*, *Cladosporium*, and *Alternaria* were the most representative genera of fungi among those identified in the surveys, being a constant presence in all locations analysed. In some locations, the concentration of fungal spores determined exceeded the recommended upper limit for indoor premises (>700 CFU/m<sup>3</sup>), this contamination having the potential to put occupants at risk of developing respiratory problems.

Chapter II, Professional and academic achievements, contains the most important results of scientific research and publications that I have obtained after the completion of my PhD thesis, namely: I have published 3 teaching manuals in national publishing houses, 3 textbooks in international publishing houses, 2 practical work guides and 1 chapter in a national publishing house. I have authored 21 ISI/ISI proceedings (4 ISI papers were awarded by UEFISCDI), 83 BDI articles, 12 articles published in international conference volumes and 3 articles published in B+ indexed journals. The research has resulted in 5 research projects as project director and 34 projects as active member of the research team.

Section II presents the plan for the evolution and development of my professional, scientific, and academic career, in which I have included the proposed objectives as well as different possibilities for their implementation.

Section III includes a list of the bibliographical references consulted in the preparation of this thesis and the articles included in this synthesis.

