

ABSTRACT

The present Habilitation Thesis entitled *Capitalization of autochthonous vegetal species: from biomedical applications to nanotechnology* is divided into three parts: 1) professional and scientific accomplishments, 2) plans for evolution and development of the professional, scientific and academic career and 3) references.

The scientific and professional achievements underlying this thesis correspond to the post-doctoral thesis (2010), to date, and include the most relevant scientific results obtained in research projects, and not only, and disseminated in the form of scientific papers published in prestigious journals in the field.

The accomplished researches were outlined and developed on ***three main scientific directions of research***:

- Exploitation of spontaneous and cultivated flora: natural extracts source with biomedical applications
- Exploitation of spontaneous and cultivated flora: possibilities to phytosynthesized nanomaterials;
- Exploitation of spontaneous flora: application in phytoremediation.

The first direction of research is described in this thesis, in the current context of knowledge, and personal achievements are divided into the following categories:

✚ ***Obtaining and application of natural extracts with antimicrobial and antioxidant properties***

– In this context, the possibility of obtaining low costs and high efficiency recipes for the removal of biodeteriogens based on natural extracts (*Ocimum basilicum*, *Allium ursinum*, *Lavandula angustifolia*, *Calendula officinalis*, etc.) has been evaluated. We have also developed new methods for obtaining natural extracts, thus obtaining non-chemical products based on biologically active compounds with antioxidant and antibacterial properties (recipes based on *Achillea millefolium* L., *Heracleum sphondylium* subsp. *Sphondylium*, *Agaricus Blazei* Murrill., *Agaricus bisporus* J.E. Lange). Methods for determination of macro- and micro-elements from *Betulae folium*, *Rubi idaei folium* have been developed and validated. The contributions described in this part have been published as 6 papers in ISI journals.

✚ ***Complex studies regarding biomedical applications*** –complex, transdisciplinary studies of

potential biomedical applications (genoprotective, antioxidant, antifungal, anti-inflammatory, mitodepressive) of natural extracts have been performed (*Juniperus communis* L., *Arctium lappa* L., *Veronica persica* Poiret). The results have been published in high impact journals (BMC Complementary and Alternative Medicine -FI-2,288 and Food and Chemical Toxicology – FI- 3,977).

The results obtained in the scientific approach indicate the possibility of using natural extracts as strong and safe therapeutics, obtained with low costs, compared to the synthesized agents currently used.

✚ **Review papers** – in the present thesis are mentioned review papers published in ISI journals (Current Opinion in Food Science - FI-3.734, Molecules - FI- 3.098 and BioMed Research International – FI -2.583), and describe the recent progress regarding the *in vitro* and *in vivo* evaluation of natural products biomedical properties.

For the second research direction the presentation of scientific results is performed in the actual context of knowledge, and personal achievements have pursued the following aspects:

✚ **Preliminary studies of obtaining and characterization of metallic phytosynthesized nanoparticles** – In this context were obtained through different methods, extracts from vegetables and medicinal plants (*Anethum graveolens*, *Salvia officinalis*, *Lavandula angustifolia* Mill., *Calendula officinalis*, etc.), with which nanoparticles of noble metals (gold and silver) were prepared. All the studies presented have opened the perspectives of applying these green technologies based on phytosynthesized nanomaterials, in biomedical domain (as drug delivery systems) or biotechnology. The contributions described in this part have been published as 6 papers in ISI journals.

✚ **Complex researches regarding phytosynthesized nanomaterials with biological properties** - At this stage complex studies of obtaining silver nanoarchitectures with improved antifungal and antioxidant properties were performed. The obtained materials were analyzed from an analytical point of view but also from the point of view of cytotoxicity and phytotoxicity. These nanomaterials were obtained with *Anthriscus cerefolium* (L.) Hoffm., *Asplenium scolopendrium* L., *Melissa officinalis* L., *Aconitum toxicum* Reichenb. All the conclusions based on scientific research allow us to propose the spontaneous species as a great resource for obtaining nanomaterials with biomedical applications, by ecological methods. Contributions described in this part are based on 5 papers published in high impact ISI journals (Scientific Reports - FI=4.122 ; Journal of Cluster Science FI=1.715 ; Materials Science and Engineering: C- FI=5.08; Industrial Crops and Products FI=3.849; Applied Surface Science- 3.15 Top 1 Journal in Material Science domain, Journal of Material Science -IF-2.993).

For the third research direction the presentation of scientific results is performed in the actual context of knowledge, and personal achievements have pursued the following aspects:

Proposing *Lolium perenne*, *Festuca pratensis*, *Stipa capillata*, *Agrostis alba*, *Cynodon dactylon*, *Luzula campestris*, și *Agrostis tenuis* as potential plants for bioremediation ca plante potențiale pentru bioremediere following a study conducted in Dâmbovița County, in the industrial zone, and *Asplenium scolopendrium*, *Asplenium trichomanes-ramosum*, *Cystopteris fragilis*, *Polypodium vulgare* (studies have been performed for the Argeș area).

A subchapter dedicated to the presentation of research projects and patent applications is also presented. The first research project based on these directions was the one realized as a post-doctoral project, *Exploitation of selective natural extracts for biological decontamination of buildings*. The complex projects in which these priority research axes are developed to which I am responsible or the director are also described: *Increasing the institutional capacity of bioeconomic research for the innovative exploitation of indigenous vegetal resources in order to obtain horticultural products with high added value* with component projects: *Development of vegetal extracts and innovative phytosynthesized nanostructured mixtures with phytotherapeutic applications to reduce biocenotic stress in horticultural crops* and *Innovative technologies for advanced processing of vegetable resources from fruit growing and viticulture*. the project proposes innovative recipes based on indigenous vegetal resources in order to obtain horticultural products with high added value. Both the research projects and the patent applications were the result of the research activities and were awarded at international fairs and exhibitions.

This Habilitation thesis is the result of my scientific achievements succinctly presented as follows: 26 papers published in ISI journals with a total impact factor 52.43, from which at 15 papers with impact factor 37.93 I am main author. For my entire career Hirsch Index is 10.

The third chapter of the thesis presents plans for evolution and development of the professional, scientific and academic career and focuses on the following aspects:

- Development of new “green” formulations with practical applications in agro food sector and pharmaceutical, through capitalization of spontaneous and cultivated species with particular aspects as: New possibilities to extract and purify of bioactive compounds; Production of recipes, study the toxicity of products - plant, soil interactions; The possibility to apply the obtained products in large scale; investigation of nanomaterials as carriers to entrap, encapsulate, absorb, or attach active molecules to control pests and diseases in agriculture.

- Development of new “green” formulations with practical applications through valorisation of vegetal and agro-food waste. The main objective of this thematic area will be the development innovative technologies for the sustainable valorisation of wastes from horticultural and wine industry, with future market applications in obtaining value-added products.

In conclusion, the main objective of the careers was, is and will be that of professional self-improvement so that I can carry out my research activity at a high-quality level, in the Horticulture Faculty, respecting both my own principles, and the qualitative and ethical ones adopted by the Charter and the Strategic Plan of University Of Agronomic Sciences And Veterinary Medicine Of Bucharest.

Key words: spontaneous flora, horticultural species, biomedical applications, nanotechnology