SUMMARY

of the doctoral thesis entitled:

RESEARCH CONCERNING THE VALORISATION OF NUTRITIONAL, PHARMACOLOGICAL AND ORNAMENTAL POTENTIAL OF SOME SPECIES OF INDIGENOUS AND EXOTIC FRUIT SHRUBS

Candidate for PhD's degree: TOMA Mariana
Scientific coordinator: Prof. Ph. HOZA Dorel

KEY WORDS: acclimatization, containerized culture, innovative nutraceutical products, antioxidants, apoptosis, autophagy, flower arrangements

The general objective of the present work is the cultivation, research and promoting of new or less known plant species in our country, particularly valuable as nutritional, pharmacological and ornamental potential.

Experiences on the behaviour of exotic fruit-bearing shrubs investigated in the thesis at containerized culture and the attempts to acclimatize them for large-scale cultivation are pioneering work in our country.

The fruit shrubs studied have both culinary and therapeutic properties. Different plant organs are used for the treatment of various ailments and imbalances, as well as prophylactically, not only in Ayurvedic medicine, but also widely used in the pharmaceutical, dermato-cosmetic and perfume industries.

The highly valuable, but under-explored pharmacological potential of the fruit shrubs species, in particular guava and curry tree, may hold the key to cure many of the ailments challenging our modern society.

All the plants studied fulfil a particularly decorative and health-giving role for the spaces they occupy and ennoble, as they are not toxic or allergenic. Each species studied decorates with its habitus, foliage, flowers and fruits.

All the shrubs researched in the thesis were cultivated and monitored at the Research and Development Institute for the Processing and Marketing of Horticultural Products - "Horting", Bucharest. For the establishment of the experiment, young plants were purchased from national nurseries, as well as seedlings of curry tree from a British nursery. The guava plants were produced by germinative way by the author.

The species and varieties of native fruit shrubs that are the subject of this research are: *Vaccinium corymbosum L.* (blueberry): *Bluegold, Duke, Legacy*; *Amelanchier alnifolia Nutt*. (saskatoon): *Martin, Smokey, Thiessen*; *Amelanchier x lamarckii* (juneberry) and *Aronia melonocarpa Michx.* (black chokeberry): *Galitianka, Hugin, Nero, Viking.*

The exotic species used are: *Murraya koenigii Spreng.* (curry tree): standard variety, very fragrant variety, dwarf variety; *Plumeria sp.* (frangipani): *California Sunset, Divine, Exotica, Inca Gold, Jubilee, Mini White, Star White, Thumbalina* and *Psidium guajava L.* (guava): *Allahabad Sapheda, Bianca, Florida, Florida Tropical, Red Apple, Red Giant, Ruby Supreme, Thai Apple, Thai Rubby.*

The paper is structured in 2 parts: Part I - Bibliographic study and Part II - Personal research. The first part is composed of 2 chapters, as follows: the first chapter is a concise presentation of the culture of fruit shrubs, in general and, in particular, in our country, and the second chapter is structured in 5 subchapters, in which the indigenous and exotic species of shrubs that are the subject of the present research are described, as well as a comprehensive description of their nutritional, pharmacological and decorative use. Part II - Personal research - opens with the third chapter in which the objectives, material

and method used to obtain the results are presented. It describes the methods and apparatus used to perform biochemical and physio-chemical analyses, substrate and microscopic analyses, cell line analyses, the materials required for the flower arrangements and the statistical processing of the data obtained. In the fourth chapter the results concerning the production of planting material, the biology and cultivation technology of some species of fruit shrubs - with reference to the production of guava plants by germination; the cultivation characteristics of the plants studied; the macroscopy of exotic species; the microscopy of tropical species; the soil-plant relationship and growth dynamics - are presented in detail; results concerning the valorisation of the nutritional potential - with reference to biochemical analyses of fresh fruit; processing of fruits by dehydration and pasteurization; range of food products produced; organoleptic evaluation of the obtained products; results concerning the valorisation of the pharmacological potential - in which reference is made to the evaluation of the antioxidant capacity of the studied species; products with pharmacological properties from the leaves, flowers and fruits of the current paper species; apoptosis and autophagy in colon and prostate cancers; results concerning the valorisation of the decorative potential - with reference to the aesthetics of the cultivated shrubs; shelf life of frangipani flowers; flower arrangements. The fifth chapter is a quintessence of the whole work, presenting the conclusions concerning the containerized culture of the studied shrub species, conclusions and recommendations concerning the valorisation of the nutritional, pharmacological and decorative potential, as well as opening new research directions.

The concept of growing native and exotic shrub species in containers proved to be inspired, safe and easy to manage. Thus, the indigenous fruit shrubs: *Vaccinium corymbosum* (blueberry), *Amelanchier alnifolia* (saskatoon), *Amelanchier lamarckii* (juneberry) and *Aronia melanocarpa* (black chokeberry) were well adapted to containerized culture. They grew and fruited as field plants. The technological works (including blueberry pH adjustment), phytosanitary inspection and pest control could be thoroughly performed, even the monitoring of container-grown plants was easier. As for the tropical shrubs in this paper: *Murraya koenigii Spreng.* (curry tree), *Psidium guajava L.* (guava) *and Plumeria sp.* (frangipani), their approach represents an Avant guard work for our country. Due to the climate change and grow concept, the fruit shrubs from the tropical and subtropical regions of the globe have shown good adaptation in our country. Between May and early November, they can be outdoor cultivated.

The morphological and anatomical studies carried out on exotic species - leaf, petiole, pedicel, rachis and stem cross-sections – provided valuable information relating the adaptability of new exotic species in our country. On this basis, was realized the first botanical inventory of curry tree, guava and plumeria in our country. Macro- and microscopic analyses showed that the growth and development of tropical shrubs follow the same curves and characteristics as native plants. In the curry tree, notable, even surprising, were: accelerated height growth, early flowering, indoor fruiting and new plants produced from the seeds of the harvested fruits, and also by suckers (only at standard variety). At guava, healthy vegetative growth and resistance to disease & pest attack and stress factors were noted, and at plumeria abundant & qualitative blooming.

Each of the 7 species analysed in this paper has at least an edible organ, as follows: fruit (blueberry, saskatoon, juneberry, black chokeberry, guava), flower (frangipani) and leaves (curry tree). The analyses of the bio-compounds found in the tropical shrubs studied in this paper revealed values close to those of the plants from native or naturalized areas, the above statements being based on thorough, responsible and passionate documentation work. Bio-chemical and physio-chemical analyses pointed out their rich nutrient content, and the complementarity of tastes, aromas and textures, as well as the synergy of pharmacodynamic principles, which have been highlighted by the realization of natural, safe, healthy and innovative products. The assortment ranges are composed of products obtained by dehydration and pasteurization, the experiments being carried out in 3 consecutive years for each species and variety. Fresh and dehydrated fruits of the studied shrubs were basic ingredients in the elaboration of confectionery & ice-cream products, as well as in the production of two original fruit bars. The new products were sensory evaluated by a variable number of respondents, with relevant and constructive scores and suggestions.

The evaluation of the antioxidant capacity of the species investigated in this thesis meets the

increasingly needs of the society we live in. The modern lifestyle, post-pandemic adaptation, reconfiguration of priorities are all reasons to find viable solutions to today's challenges, particularly in health and nutrition. Exclusive or adjuvant herbal treatments may be slower-acting than those proposed by allopathic medicine, but the plants bio-compounds are gently acting, treating not only the symptoms but, especially the root cause.

Herbal remedies, used since immemorial time, are still labelled as backward and questionable methods of treatment. Ancestral knowledge, validated by the time and the modern techniques, through the mediation of specialists, is the key to remedying or preventing most diseases and imbalances. For the most dreaded disease of our times, which spares neither children nor those who strive to live a balanced life - the cancer - this work brings hope for life and recovery. The ethanolic extract from guava leaves has shown unbeatable efficacy in colon and prostate cancers through the processes of cell apoptosis and autophagy. All fruit tree species investigated in the present work showed amazing results in terms of antioxidant capacity and nutrients content, highlighted by emergent technologies.

In addition to their nutritional and health-giving importance, the species of fruit shrubs studied in this paper also have spectacular ornamental values. The plants' habitus, foliage, flowers and fruits, colour, fragrance, etc. are indicators of the aesthetic and comforting functions that the plants in this study have in abundance. Each species has its own beauty, uniqueness and charm. The more professionally and lovely the plant is cared for, the healthier it is, the more intensely coloured & fragrant and the longer the flowers can last in flower arrangements. Both indigenous and exotic shrubs have delighted the eye, senses and soul throughout the growing season, being once again highlighted within European and Oriental-style flower arrangements. All the floral creations in this thesis are original, made only from the organs of the plants cultivated into the experience.

The present material has proposed a focus on the valorisation of some species of fruit shrubs, both from an ethno-medical point of view, as a link between ancient and modern practices, as well as from a food and ornamental point of view. Fruit trees are not only a primary source of food; they are alive entities with healing and harmonizing functions. Their beauty and charm are excellent therapies in the fight against stress, anxiety and frustrations of modern paced-life.

Alternative medicine is gaining more and more confidence among people all over the world, because natural remedies, used at the recommended doses, do not have side effects or adverse reactions or they are minimal, acting safely and gently on the body, even if more slowly than allopathic remedies. The range of doctors' knowledge has widened, presenting more flexible points of view, more inclined to recommend herbal treatments as adjuvants in diseases of various aetiologies.

The particularly valuable bioactive components contained in the leaves of fruit shrubs, but also in other plant organs, should increase the interest of scientists in order to be able to use them to combat diseases that have developed resistance, thus exploiting their potential for synergistic applications.

The species of indigenous fruit shrubs presented in the thesis are particularly valuable, being a true health reservoir. Alongside the well-known fruits of blueberry and aronia, the berries of *Amelanchier sp.* were the surprise element. The two species investigated, *Amelanchier alnifolia* (saskatoon) and *Amelanchier lamarckii* (juneberry) offer the advantage of plenty of antioxidants and valuable nutrients contained in fruit; pleasant & balanced taste; versatile use; easy cultivation, being semi-hardy species with high adaptability on wide range of pH.

The exotic species investigated in the present work represent a novelty and a challenging work in the field of plant acclimatization and valorisation of horticultural products.

Their containerized culture and the highlighting of their usefulness in innovative food products and medical and pharmacological trials have laid the foundations for a cutting-edge approach, breaking new ground in health and nutrition.

The results of this study can serve as a source of information for researchers, horticultural engineers, farmers, processors, providing appropriate standards for future investigations and applications in biomedicine, pharmaceuticals, cosmetics, biotechnology, etc. The aim of the present study is to analyse the bio-compounds with significant nutritional and therapeutic found in the fruit shrubs and to implement the results obtained by creating original and natural food products and herbal remedies

with synergistic action and exceptional values in terms of nutrition and human health.

My vision is to match as effectively as possible the theoretical knowledge and practical experience gained in the country and abroad, with innovative techniques and cutting-edge research, in order to create products that meet the current and future needs of society.