

SUMMARY

"The cures are made from earth and the wise man will not abhor them." The Bible

With the development of society, the term "medicinal plants" takes on new connotations, this category includes plants with a spice, aromatic or tinctorial role. The interest in the study of medicinal plants has been on the rise, especially since the market for organic and body-care products is constantly growing. Lately, the population is aware that pharmaceuticals or food supplements extracted from plants have fewer negative repercussions on health. If in the past herbal medicine was mainly intended for the poor in underdeveloped countries, nowadays research has led to standardized products, so plant extracts are purchased with increasing interest by the citizens of developed countries.

The *Lamiaceae (Labiata)* family, also known as the "mint family", includes a large number of genres that are of interest to the above-mentioned industries. It is composed of over 7000 species noted for their bioactive components, but also for their extremely high ecological plasticity. The genus *Nepeta* comprises about 250-300 species, used in many industries.

The ever-changing consumer demand and growing interest in natural products, especially essential oils, were the basis for initiating this study.

The doctoral thesis entitled "Research on the biology and technology of some species of the genus *Nepeta* to increase its production and quality in the conditions of the forest-steppe of Moldova" is structured in accordance with the regulations of the Doctoral School of Engineering Sciences, Iasi University of Life Sciences, in two parts.

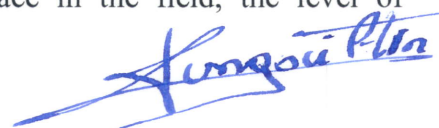
The first part, entitled "Current state of knowledge in the field", is divided into 3 chapters and totals 65 pages, and the second part "Interpretation of results obtained" consists of 6 chapters and totals 135 pages. In addition to the content, the paper has an introduction, a summary, and at the end a list of figures, tables, abbreviations, and a list of the published papers.

The first part is structured into 3 chapters and summarizes the most important scientific achievements in the field of medicinal and aromatic plants with direct reference to the genus *Nepeta*.

Chapter I, entitled "Brief History of Medicinal Plant Research. Considerations on the genus *Nepeta* L." is divided into two subchapters. In the first subchapter, a brief history of the cultivation and use of medicinal plants from the beginning to the present day is reviewed. The second subchapter presents the new valences that medicinal plants have acquired, namely as medicinal, food, and nutraceutical components, in the cosmetic or plant protection industry.

Chapter II, entitled "Origin, systematics, morphology, biology, and ecology of the genus *Nepeta* L.", is structured into 4 subchapters, dealing with the centers of origin of the two studied species, other representative species of this genus existing in our country, and the classifications in force. Elements of biology, morphology, and anatomy of the species are also presented.

Chapter III, entitled "Technology of cultivation of species of the genus *Nepeta* L." has one subchapter that presents the main technological links necessary to establish a culture of *Nepeta* with the particularities of each species. From the place in the field, the level of



fertilization, and the optimal timeline, the main works of the soil, the way of establishing the culture, the maintenance, the harvesting, and the conditioning of the raw material, all stages are discussed.

The second part, entitled "Interpretation of results obtained", is structured into 6 chapters, ending with the bibliography and annexes. This section is constructed based on the milestones of my research, by describing the study area, the influence of differentiated fertilization, the influence of saline stress, and the antimicrobial activity of biocomponents on the studied species. In the final chapter are drawn the conclusions, recommendations, and directions for future studies.

Chapter IV consists of 5 subchapters in which, separately, the pedoclimatic conditions are discussed, starting from the positioning of the area, the geological structure of the relief, the main upper and deep-water sources, the climate characteristics of the multiannual and the last two years, soil profile, and its chemical analysis.

Chapter V presents the scientific framework on which the research was conducted. It is structured into 5 subchapters, namely the aim of the study, the materials and the methods applied in the field and laboratory, the equipment and reagents used, and finally the processing and interpretation of the data. All the analyzes and determinations were performed according to the standard methods, indicated by the literature, which in a few cases they required an adaptation to the studied conditions.

Chapter VI presents the effect that different concentrations of salts (NaCl, Na₂SO₄) have on the two studied species. The aim was to increase the efficiency of land use in the case of soil with a high degree of salinization. The experiment was established in vegetation vessels, with well-controlled factors, highlighting the increase of the concentration of the main biocomponents responsible for the defense mechanism of plants, respectively polyphenols and flavonoids. Also, chlorophyll and antioxidant activity were much higher than for the control (untreated) variant. In contrast, the accumulated biomass was much smaller, the plants had a smaller size, and the phenological stages took place in a much shorter time.

The glandular trichomes analyzed by electron microscopy technique showed that, as the salt concentration increased, the size of the secretory formations decreased, as well as the distance between them in *Nepeta cataria* L., while for *Nepeta racemosa* Lam it increased. Also, correlation coefficients were calculated between the analyzed parameters, and discussions were made based on all the results.

Chapter VII addresses foliar fertilization using 3 products, which had different concentrations of macro and micro-elements. The extracted volatile oil was analyzed by GC-MS to highlight the main compounds and their concentration. As in the case of many species, the chemotype was comparable to the values reported in the literature. Also, the content of polyphenols, flavonoids, chlorophyll, and antioxidant activity, and yield were determined.

Chapter VIII - entitled "The antimicrobial effect of *Nepeta cataria* L. and *Nepeta racemosa* Lamoil." presents the practical applicability of the results obtained through an "in vitro" antimicrobial analysis. Six bacterial strains were analyzed, of which 3 were Gram-positive and 3 Gram-negative. Comparisons were made in all cases with gentamicin. It was found that

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with 25 µl of volatile oil, the level of inhibition was much higher in Gram-positive strains than in Gram-negative ones. Studies continued to elucidate the mode of action of the volatile oil. It has been found to affect the bacterial cell wall, leading to cell disorganization. Next, the two oils were embedded in film and gel polymer matrices, and the retention characteristics of the oils and their slow-release mode were studied by UV-VIS spectrophotometry, Fourier Transform Infrared Spectroscopy (FTIR), Scanning electron microscopy (SEM), and optical microscopy. After the determination of these parameters, a new antimicrobial analysis was carried out, from which it was found that there were no significant differences between the two film/gel preparations, for all analyzed microorganisms (*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*). The end of the chapter some conclusions were presented as well as some similar results reached by other authors.

The thesis ends with conclusions and recommendations, which are outlined in **Chapter IX**. They are structured as follows: biochemical, physiological, biometric, and antimicrobial outcomes. The end of the chapter presents perspectives and directions that we want to address in future studies.

A handwritten signature in blue ink, appearing to read 'Xunqiu Lin', is written in a cursive style with a long horizontal stroke extending to the left.