

ABSTRACT

Keywords: *Artemisia*, growth, cultivation, production, volatile oil, antimicrobial effect, phytotherapy.

The genus *Artemisia* L. belongs to the *Asteraceae* family and includes perennials, but also annuals of particular importance, due to their use for medicinal, aromatic and food purposes.

The issue addressed in this doctoral thesis focuses on the need for biological knowledge and technology of cultivation of some species of the genus *Artemisia*, in order to cultivate them for phytotherapeutic, aromatic and food purposes.

The researches carried out for the elaboration of the doctoral thesis entitled “*Researches on agro-biological and technological peculiarities in some species of the genus Artemisia with special regard to its production and quality for complex use*”, were carried out in 2015-2017, in the experimental field of the discipline of *Phytotechnics*.

The analyses were conducted in the laboratory of the *Phytotechnics* discipline, within the Faculty of Agriculture and within the Faculty of Veterinary Medicine of University of Life Sciences ”Ion Ionescu de la Brad”, Iași.

The purpose of the doctoral thesis was the comparative research of some native and adventitious species of the genus *Artemisia* L. in the climate and soil conditions, of the Iași area, in order to introduce and/or extend them in culture. Also, the species *Artemisia annua* L. was studied in conditions of different density as well as its reaction at different distances between rows, in order to improve its cultivation technology.

In order to achieve the proposed goal, the following objectives have been set:

- ✚ knowledge of the effect of environmental factors in the Iasi area in 2-3 different years on the growth, development and production quality of *Artemisia* L. species studied in different organs and phenophases;
- ✚ study of some physical-chemical properties of the vegetal raw material produced by the nine species cultivated in the experimental field;
- ✚ study of the dynamics of biomass and volatile oil accumulation in order to establish for each species the optimal harvesting time, in order to maximize its production and quality;
- ✚ study of the behavior of *Artemisia annua* L. in climatic conditions of the research years at different densities and distances between rows;
- ✚ elaboration of a partial cultivation technology of the *Artemisia annua* L. species;
- ✚ study of the antibacterial effects of some extracts from the experimented plants, in view of their complex use.

A first experiment concerning the comparative cultures of the nine species of *Artemisia* respectively: *Artemisia absinthium* L., *Artemisia abrotannum* L., *Artemisia vulgaris* L., *Artemisia dracunculus* L., *Artemisia austriaca* L., *Artemisia pontica* L., *Artemisia lancea* Vaniot, *Artemisia lavandulaefolia* D. C, *Artemisia argyi* H. Lev. & Vaniot.

The experiment was monofactorial, the factor **A** having nine graduations, respectively the species studied with the variants:

- a1–*Artemisia absinthium* L. (V1)
- a2- *Artemisia abrotannum* L. (V2)
- a3- *Artemisia argyi* H. Lev. & Vaniot (V3)
- a4- *Artemisia austriaca* L. (V4)

- a5- *Artemisia dracunculus* L. (V5)
- a6- *Artemisia lavandulaefolia* D.C. (V6)
- a7- *Artemisia lancea* Vaniot (V7)
- a8- *Artemisia pontica* L. (V8)
- a9- *Artemisia vulgaris* L. (V9)

The experiment had 2 repetitions, the surface of a plot was 9 sqm, the distances between rows and between plants in a row in each plot were different, depending on the requirements of each species.

The second experiment concerned the species *Artemisia annua* L., where a cultivation technology was developed and where special emphasis was placed on different sowing distances (50, 70, 100 cm) and on different plant densities, respectively. The material from the local spontaneous flora was used for the establishment of limited plots with an area of 21 sqm (5x4.2 m) each, in 3 repetitions.

The doctoral thesis is structured in two distinct parts, totaling a number of 9 chapters, and contains a number of 196 pages, 28 tables and 41 figures and graphs.

The first part, entitled "*Actual state of knowledge of research in the related field*" comprises 3 chapters, with a number of 68 pages, with a weight of 34,01%, and refers to general considerations on the genus *Artemisia*, *Artemisia* species being studied, systematics and chemical composition of the genus *Artemisia*.

In part II - entitled "Presentation and interpretation of experimental results. Conclusions and recommendations" 5 chapters are included comprising 129 pages representing a weight of 65,99% Here is information on the natural environment of the area where the research was conducted, the purpose, objectives, research material and method, results on phenology, and elements of productivity and composition in the species studied, research results on antimicrobial activity of *Artemisia* species studied, the results of technological research on the species *Artemisia annua* L.

The bibliography includes a number of 135 specialized titles, both from the country and from abroad.

The first chapter of the thesis consists of a short history of research of medicinal plants in all aspects, emphasizing the importance and uses of species of the genus *Artemisia* L.

The second chapter presents the current state of research undertaken in the country and abroad, on the topic studied. Here are mentioned issues addressed by researchers around the world, which address the biology and systematics of the genus *Artemisia* L., the quantity and quality of production of the genus studied, the use of *Artemisia* L. species for medicinal, aromatic purposes, but also in other fields. The systematics of the genus *Artemisia* is presented up to the level of subdivisions and species, with the presentation of those studied. This chapter also addresses the chemical composition of the genus *Artemisia* L.

The third chapter presents in detail 10 species of *Artemisia* that have been studied. Of these, 7 species are spread over large areas and in the spontaneous or cultivated flora of Romania, 6 species being perennial (*Artemisia absintium* L., *A. abrotanum* L., *A. austriaca* L., *A. dracunculus* L., *A. pontica* L., *A. vulgaris* L.), and one of them, annual (*Artemisia annua* L.).

In addition to these, 3 adventitious species were studied which were recently discovered in the Iasi area by Sîrbu, C. and Oprea A., two of which are new species for Romania and one is considered a new species for Europe. The authors describe them in many ways, including the location of their discovery, where they were procured from to set up the

experiments. These species are *Artemisia argyi* (H. Lev and Vaniot), *Artemisia lavandulaefolia* D.C. and *Artemisia lancea* (Vaniot).

The fourth chapter presents the natural setting of the area where the research took place, namely:

- ✓ geographical, geological and relief location;
- ✓ geomorphology, geology, lithology and hydrology;
- ✓ thermal and pluviometric regime in the years experienced;
- ✓ relative humidity;
- ✓ the soil and its characteristics in the area

The fifth chapter presents the purpose and objectives of the doctoral thesis, the biological material being used, the outline of the two mounted experiments and the research methods performed in the field.

The following operations were performed in the laboratory:

- ❖ weighing the samples and determining the percentage of dry matter by kiln drying, biomass per plant and per unit area;
- ❖ obtaining extracts from the 9 species of *Artemisia* and from the control *Tanacetum vulgare* by the method of entrainment with water vapor;
- ❖ determination of the volatile oil content in both experiments;
- ❖ determination of the antimicrobial effect of the 12 *Artemisia L.* extracts.

Chapter six presents the results on phenology and the elements of productivity and composition in the studied species. There are presented detailed results of the experiments regarding:

- phenological observations in the species studied;
- the growth dynamics in the years in 2015 and 2016 for the studied species;
- the influence of the “species” factor on the height of the stems;
- grass production when harvesting species;
- dynamics of volatile oil accumulation in the studied *Artemisia L.* species.

These parameters were monitored throughout the vegetation period in the experimental years, presenting the results obtained for each experimental year, but also the average of the years. In this chapter there are highlighted the variants with the species that obtained the highest values of the researched indicators, respectively which are best suited to the pedo-climatic conditions in the Iași area.

Chapter seven presents the results of research on the antimicrobial activity of *Artemisia L.* species studied.

Research on the antimicrobial effect of the species of the genus *Artemisia L.* studied was determined for the purpose proposed by the research topic, namely how these species can have multiple uses, in addition to strictly therapeutic such as: food industry, preparation and preservation of products, agriculture (crop protection), keeping hygiene indoors, etc.

Many species of the genus *Artemisia L.* are mentioned by various authors as having antibacterial, fungistatic, fungicidal and moderate inhibitory effects of some species very harmful to agriculture. Research has shown the antimicrobial action of *Artemisia L.* species, which varied depending on the bacterial strain with which it interacted, their *in vitro* efficiency being evident against Gram-positive bacteria and less obvious against gram-negative bacteria.

Chapter eight presents the results of technological research on the species *Artemisia annua L.* In this regard, observations were made and results were obtained on the growth and development of *Artemisia annua L.* plants, on its production and quality. Also, in

this chapter are presented results of the dynamics of volatile oil accumulation from *Artemisia annua L.*, drying dynamics and drying efficiency of the plant aerial part (herba).

All being important elements for production practice, they have been correlated with the distance between rows and crop density, thus laying the foundations of important technological links in the cultivation of this species. Thus, it was found that for a successful cultivation it is preferable to set up by planting the seedling previously prepared compared to setting up by sowing directly in the field.

When cultivating *Artemisia annua L.* for the production of the aerial part of the plant (herba), the distance of 50 cm between rows and a density of about 70.000 pl / ha is preferred, and when it is cultivated to obtain volatile oil, the distance between rows of 70 cm and a density is preferred. of about 50.000 pl / ha.

The optimum time for harvesting for both grass and volatile oil is in full bloom.

The paper ends with **conclusions** drawn from the research conducted, the interpretation of results, for each chapter and for each experience, each result determining some recommendations for both basic research and production practice.

The bibliography includes a number of 135 titles of which 79 belong to foreign specialized literature.