SUMMARY

Keywords: Monarda, morphological characters, production, quality

The genus *Monarda* L. belongs to the family *Lamiaceae* and comprises annual and perennial plants of significant importance due to their use for medicinal, aromatic and decorative purposes.

This research thesis focuses on the necessity of understanding the biology and the cultivation technology of the plants from the genus *Monarda* L., with a view to growing them for medicinal and aromatic purposes.

The research conducted for the elaboration of the doctoral thesis entitled "**Research on the biology and cultivation technology of some species of the genus *Monarda* L. with a view to starting to grow them in the pedoclimatic conditions of Moldavia**" was conducted over the 2010-2013 period, in three Moldavian regions with different climatic conditions. The tests were carried out in the Phytotechnics Laboratory of the Faculty of Agriculture of USAMV Iași, and in the laboratory of Morphology and Plants Anatomy and Chemistry of the Faculty of Biology of UAIC Iași.

The doctoral thesis was aimed at studying the biology and cultivation technology of some species from the genus *Monarda* L., with a view to starting to cultivate them in different pedoclimatic conditions.

In order to accomplish the aim of the paper, the following objectives have been established:

1. The quantifying of the effect of investigated factors on biomass accumulation and distribution of air in different organs of the studied species fenofaze;
2. The histo-anatomically study of the leaves and stems of cultivated Monarda plants;
3. The study of some physico-chemical features of vegetable raw materials (plant organs, determination of moisture determination of total solids etc.);
4. The establishment of physiological and biochemical parameters of the tested species;
5. The quantification of the quantity and quality of production of raw material;
6. The development of culture technology for three species of the genus Monarda.

In order to achieve the above mentioned objectives, the following activities have been carried out:

- study of the pedoclimatic conditions of the analyzed regions;
- cultivation of the experimental fields;
- study of the morphological, phenological, growth and development particularities of the plants in the pedoclimatic conditions specific to the three cultivation regions;
- biochemical and physiological laboratory investigations;
- analysis of the quality of the production.

For the achievement of the established aims and objectives, we resorted to three factor experiments, located in subdivided lots; the experiments were conducted three times, over a three years' period (2011-2013) and we analyzed the influences of the studied factors on the morphological characters, quantifying production and quality.

The biologic material used for our experiments was comprised of three species of the genus *Monarda* L.: an annual species (*Monarda citriodora* Cerv ex Lag.) and two perennial species (*Monarda didyma* L. and *Monarda fistulosa* L.).

The experiments took place in three regions with different climatic characteristics from Moldavia, namely: the Pojorîta region, the Iași region and the Vaslui region.

The experiments comprised variants with plants obtained from seeds sown directly in the field, at 50 cm row spacing, and variants obtained from seedling, at a 40 cm distance between the plants on the same row and at 50 cm row spacing, thus obtaining 50000 plants/ha.

The doctoral thesis is divided into two distinct parts, comprises 8 chapters, 255 pages, 131 tables and 115 figures and charts.

The first part, entitled "*State of knowledge at a national and international level*" comprises 3 chapters, with a weighting of 31,76 %, which refer to the general considerations concerning the genus *Monarda* L., the current state of research on the topic under discussion and the natural setting of the regions where the research was conducted.

Part 2, "*Presentation and interpretation of experimental results"*, has a number of 5 chapters, with a weighting of 68,24 %, which refer to the research aim, objectives, research material and method, the results of the research on the biology and cultivation behavior of the Monarda species, the results of the research conducted in the laboratory and of the research focused on production and quality, as well as a series of conclusions and recommendations.

As references, we used a number of 220 specialized works from the country and from overseas.

The first chapter aims at describing, in general terms, the genus *Monarda* L., and deals with the importance and the use of the species from this genus, with their origin and spreading, systematics and morphological particularities, their reproduction and the ecological requirements of the studied species.

The second chapter presents the current state of research conducted in the country and overseas with regard to the topic under discussion. It focuses on aspects approached by researchers from all over the world, concerning the biology of the genus *Monarda* L., the quantity and quality of the production of the studied genus, the use of the Monarda species for medicinal, aromatic and ornamental purposes.

The third chapter portrays the natural setting of the regions where the research was conducted. In this context, we described three regions with different pedoclimatic conditions from Moldavia, namely the Vaslui region, the Iași region and the Pojorîta region. Also, we analyzed the thermal and rainfall regime of the cultivation regions in the three years of research.

The fourth chapter deals with the aim and the objective of the doctoral thesis, the biologic material used, the cultivation technology and the applied research methods.

The fifth chapter presents the results of the research concerning the biology and cultivation behavior of the three Monarda species studied in the three years of experiments.

This chapter examines in detail the results obtained from the perspective of the influence of the studied factors (species, cultivation region and manner in which the crop was obtained) on the analyzed parameters. These parameters, which were monitored throughout the entire vegetation period of the plants, include: the height of the plants before flowering, the height of the plants when they are fully flowered, the number of ramifications/stems, the length and width of the leaves, the number of whorls/inflorescences and the diameter of the inflorescence.

In order to facilitate the monitoring of the influence of the analyzed factors during the growth and the development of the studied plants, we presented the results obtained for each year of experiments, namely 2011, 2012, 2013 and the average of the three years.

This chapter focuses on the plant variants which obtained the highest values of the analyzed indicators in the three cultivation regions.

Following the biometric measurements and their analysis, we identified the Monarda species which is most compatible with the pedoclimatic conditions of the cultivation region, as well as the cultivation region which is most favorable for the development of the studied plants.

We have shown that the Monarda crop obtained through seedling, in comparison with the crop obtained from seeds sown directly in the field, registered the highest values of the morphological characters monitored during the vegetation period.

In all the three years of experiments, the region most favorable for the cultivation of the Monarda plants has proven to be the mountain region, Pojorîta, for all the monitored indicators.

As concerns the analyzed morphological characters, we have observed the fact that in 2013, the values registered for the three species of *Monarda* L. were comparatively higher than the ones registered in 2012, these characteristics being influenced by the climatic conditions from the two years.

The sixth chapter deals with the results of the experimental research conducted in the laboratory. This chapter covers aspects concerning the anatomy of the studied species, the determination of the moisture and dry matter of the analyzed plant material, determinations concerning the assimilation pigments and the activity of the antioxidant enzymes. As concerns the content of assimilation pigments, the obtained results can be correlated to a great extent with the ecological conditions from the regions where the experiments were carried out. Thus, even if chlorophyll a is found in big quantities in all the studied species in the areas with a higher level of sun exposure (Iași and Vaslui), the ratio between chlorophyll a and chlorophyll b has higher values in the Pojorîta, so as to ensure a maximum photosynthetic efficiency.

Further to the analysis of the ecological conditions on the enzymatic activity of the superoxide dismutase enzyme, the determinations have proven the fact that, for the *Monarda* species, the activity of the enzyme was more intense in the plants harvested from the experimental field in Vaslui, regardless of the species, due to the higher temperature recorded during the vegetation period of the plants.

The activity of the catalase is tightly correlated with the photosynthetic activity, as well as with the breathing of the plants. The *Monarda citriodora* Cerv. Species, ex. Lag, registered a more intense activity in comparison with the other two species, in all the regions where the experiments were carried out, the highest level being recorded in the Pojorîta region.

The seventh chapter presents the results of the research concerning the quantity and quality of the production of the studied Monarda species.

As concerns the green biomass production, we have noticed that all the three cultivated species in the variants obtained through seedling in Pojorîta obtained a superior biomass

production in comparison with the productions of the variants obtained through seeds in all the other cultivation regions. This was due to the precipitations and to the temperatures registered in this region, favorable for these species, in comparison with those from the Vaslui and Iași regions, thus leading to superior productions.

The cultivation region which favored the accumulation of essential oil, thus determining high oil productions in all the three species, is the Vaslui region. It is known that high temperatures favor the accumulation of essential oil by aromatic plants, and this has also been shown in this research.

The climatic conditions influenced the accumulation of polyphenols at the level of the leaves. Thus, the tests performed on *M. citriodora* Cerv. ex Lag. and *M. fistulosa* L. have proven the positive effect of precipitations on the accumulation of polyphenols.

The biosynthesis of the flavonoids has been influenced by the temperatures recorded during the harvesting of the samples; thus, the obtained results show a decrease in their level, correlated with the drop of average temperatures, in all the three species of Monarda.

This chapter also addresses a couple of aspects concerning a technology for the cultivation of the studied species.

Chapter 8 presents the conclusions which resulted from the conducted research and the interpretation of the results, outlining the cultivation variants with the highest efficiency.