ABSTRACT

At the same time with the isolation of active principles from plants, the scientists have succeeded in establishing their chemical structure and demonstrating how different this structure was and how it varied according to its therapeutic activity. They have also determined the physical and chemical properties of these active principles.

These properties are very important for industry, when they make drugs from medicinal plants. Establishing identity, purity and quality of medicinal interest-natural produces, which are important as raw materials in pharmaceutics, cosmetics, perfumes industry, is an essential concern of the pharmacognosis.

Among the chemical substances elaborated by the plant, the active principles are essential characters, resulting in the therapeutic quality of the products. As the quality of the product is conditioned by the concentration in active principles, their accumulation depends mainly on the plant biochemistry, which makes that the studies of vegetal biochemistry represent today an indispensable element for modern pharmacognosis.

In this case, a new action of elaborating new natural perfumery and cosmetics products was launched. Therefore, the native medicinal and aromatic flora will be valorised and the products will be used in the therapeutics of many internal and external diseases.

This PhD Thesis is found on the same modern line of launching cosmetics and perfumery preparations, having as ground the odorant and therapeutic characteristics of some cultivated plant species: *Calendula officinalis* L., *Lavandula angustifolia* Mill., *Melissa officinalis* L. and *Mentha* x *piperita* L..

This work has as aim to bring a modest contribution to the aromatic and medicinal species growing, under soil and climatic conditions of the region of Iaşi.

The PhD Thesis has a total number of eight chapters, with 338 pages, 67 tables and 87 figures.

The thesis has two distinct parts, the first part which represents a synthesis of the bibliographical data regarding the subject of the paper, the natural frame description, the

climatic conditions during the research, the material and methoda of research, here we have put the bibliography. This part has 148.

The second part are presenting the results of the research, in 190 pages, 67 tables and 87 figures.

The experimentally field took place in the Didactical field of Plant Physiology Discipline of the Uneversity of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", Iaşi.

The climatic conditions was very different, 2005 and 2006 have been good years regarding the rainfall, while 2007 has been a dry year.

Calendula officinalis

Investigations were carried out for determining growth and development stages of marigold plants and their duration.

We have determined the most adequate treatments with biofertilizers and mineral fertilizers for obtaining high quality productions, under the soil and climatic conditions of the region of Iasi. We have also determined the action of different treatments on the content of chlorophyllian and carotenoid pigments from studied plants, under conditions of the studied growing area, knowing that carotenoid pigments are a component part of the active substance in marigold.

In 2006, we carried out treatments with 3% *Azotofertil* in water. We spread it in the zone of marigold roots, and then we mobilized soil around plants. *Azotofertil* is the crop liquid of two nitrogen fixing bacteria *Azotobacter chroococcum* and *Azospirillum lipoferum*, a product supplying nitrogen and growth factors necessary to plant development. This year, the evolution of Bellezza del Paccifico variety was studied against the control (Petrana), a common marigold variety.

Under the weather conditions of 2006 in the region of Iaşi, the treatments with the *Azotofertil* biopreparation have determined in marigold the increase of the number of flowers and buds/plant and, therefore, the yield increase compared to the untreated variant.

In the studied variety *Bellezza del Pacifico*, significant differences were registered between the yellow and orange flowers variants, and the yield of this variety (7315 kg/ha) exceeded both the control (6521 kg/ha) and the *Azotofertil* treated variant (6993 kg/ha).

This variety is worthing the attention of medicinal plant growers for extended areas crops.

In 2007, at the stage of stem formation, we have applied treatments with complex fertilizers (ammonium nitrate, solid and liquid complex fertilizers).

Under the weather conditions of the year 2007, with very high temperatures and lack of rainfall, supplemented by repeated watering, the highest yield was found at the NPK + Foliar 1 fertilized variant (5820 kg/ha), followed by NPK fertilized variant (5750 kg/ha) and NH_4NO_3 fertilized variant, the yield differences being not so high.

At all the analysed variants, we have studied the content of pigments from leaves, buds and flowers by the spectrophotometrical method.

Lavandula angustifolia

The lavender crop, which was set up in the experimental field, comes from greenhouse seedlings rooted in perlite , in 2004. The used vegetal material was harvested from a three year - plantation belonging to the collection of medicinal and aromatic plants of the University.

We have analysed the quantity of inflorescences in lavender plants, according to year of vegetation, mean weight of an inflorescence, mean weight of a shrub and total production of inflorescences. We have extracted the volatile oil and determined its chemical composition and tested its antibiotic effect.

By comparing years 2006 and 2007, we found out that both in 2006 and 2007 the number of lavender inflorescences/shrub has increased from the second year crops, respectively the third year of vegetation, to those on the fifth and the sixth year, knowing that the maximum yield in a lavender plantation was reached in the seventh-eighth year of vegetation.

The production of fresh lavender inflorescences was minimum in the second year of vegetation (258.3 kg/ha), when plants flowered for the first time.

In the fifth and the sixth year of vegetation, the production of fresh inflorescences has significantly increased. In 2006, it was higher (1712.5 kg/ha) than in 2007 (1637.5 kg/ha); this yield diminution was caused by the weather conditions of the year 2007 in the region of Iasi, where the experiment field was situated.

The production of lavender volatile oil has increased from a year of vegetation to another, the very high temperatures of the year 2007 determining the increase in the quantity of volatile oil from lavender inflorescences, reaching 42.2 l/ha in the fourth year crop.

In the composition of the volatile oil, in the two years of study (2006, 2007), the oxygenated terpenic compounds had a value of 86.1% in 2006, and 88.7%, respectively, in 2007. The percentage increase has shown that the high temperatures during plant flowering registered in 2007 have resulted in accumulating a higher quantity of these compounds.

The results of tests on the antibacterial effect of lavender volatile oil have shown that most of bacterial strains (*Staphylococcus aureus, E. coli, Salmonella D, Salmonella B, Bacillus cereus*) were susceptible at the oil direct action, excepting *Listeria monocytogenes* and were susceptible at the lavender oil, being inhibited on an area varying between 0.6 and 1.5 cm. Among all the means of administering volatile oils, the internal one is the most efficient at treating infectious diseases.

Melissa officinalis

The plantation from the experimental field was set up in the spring of year 2005 by the separation of shrubs. The harvested crops were tied in bunches/shrub and analysed separately according to the year of vegetation. In laboratory, each plant was analysed separately; the shoots were numbered, weighed and then defoliated, for determining the weight of leaves and shoots.

The experimental data showed that the highest yield of balm mint leaves was obtained in plants found in the sixth crop year (11180 kg/ha), the plants forming vigorous shrubs, with a great number of shoots. It follows the yield obtained by the fifth vegetation year plants (9660 kg/ha), while the lowest yield, as it was to be expected, was obtained by the second year plants (6666 kg/ha).

The production of balm mint volatile oil was higher once with the increase in the yield of fresh plants/ha, the maximum value being obtained in 2007 (12.2 l/ha) at the fourth year crop.

The dynamics of pigment accumulation during the phenological phases in balm mint shows the content of *a* chlorophyll (662-663 nm) with the maximum value at growth period, which has progressively decreased after flowering.

Mentha piperita

The production of fresh herba harvested in the phenological phase of vegetative growth in 2006 was of 7340 kg/ha, of which the highest quantity is represented by the production of fresh leaves (60%). At their level, mint has oliferous glands, responsible for volatile oil production. The fresh stems represent about 40% of the quantity of harvested herba, and generally, it is used together with leaves (herba), separately having small quantities of active substances.

In 2007, the yield was by 30% higher than in 2006, and at the phenological phase of vegetative growth, the herba yield has increased by about 72% compared to the same phenological phase of year 2006.

In mint crop, the production of fresh herba has significantly increased from one vegetation year to another (10180 kg/ha in 2007 against 7340 kg/ha in 2006).

At the flowering stage, the quantity of volatile oil was maximum. The quantity of leaves represents half of the plant aerial part, about 40% being represented by stems and the rest of 10%, by inflorescences. At this phenological phase, the greater production of fresh herba resulted in increasing the production of dry herba, compared to the phenological phase of vegetative growth.

The mint volatile oil had different outputs at distillation, the highest one being registered at inflorescence distillation (1.02%), followed by herba at the flowering phenological phase (0.72%), while the lowest one was obtained in herba at the vegetative growth stage (0.61%). The highest quantities of the volatile oil were obtained by the distillation of fresh aerial parts at flowering, both in 2006 (88.2 l/ha) and in 2007 (92.4 l/ha).

Analysing the compound groups from the volatile oils extracted from the plant aerial part at the flowering phenological phase, we notice that about 55% are represented by monoterpenic hydrocarbons, 40% by oxygenated terpenic compounds and 5%, by sesquiterpenoids. There is a correlation between chemical structure, lypophillic capacity, their tolerance in the organism and the intensity of their bacterial action.

All the tested strains (*Staphylococcus aureus, E. coli, Salmonella D, Salmonella B, Bacillus cereus*), excepting the bacterium *Listeria monocytogenes,* are susceptible to mint oil, being inhibited on an area, which varies between 0.6 and 2 cm. The highest inhibition area of 1.5 cm was found in *E. coli*, which was the greatest value registered at all the studied samples. This proves that the mint volatile oil has the strongest action on the digestive tube or urinary infections, which the bacterium produces, having a strong antibacterial effect.

In species *Mentha piperita,* the photosynthetic activity registers an ascending dynamics on the entire vegetation period, which may be correlated to the ascending dynamics of volatile oil accumulation, while the biochemical indicators that favour the plant resistance at stress have maximum values at flowering, which might represent the response of plant adaption to stress, under conditions of a high production potential.

CONCLUSIONS

❋ The plants studied in this PhD Thesis (*Calendula officinalis* L., *Lavandula angustifolia* L., *Mentha piperita* L., *Melissa officinalis* L.) behave well at cropping, under the conditions of the region of Iasi, crossing all the phenological phases, which are specific to each species.

❋ We may think that the *Azotofertil* treatments are an efficient means of biofertilization in marigold. The maximum content of carotenoid pigments accumulated in inflorescences to the end of summer and beginning of autumn was also noticed, recommending this period as optimum from the viewpoint of the quantity of active principles from marigold inflorescences.

❋ Under conditions of year 2007 in the region of Iasi, the highest yield of marigold flowers was obtained at variants treated with solid complex fertilizers treatment, in combination with one fertilizer treatment of Foliar complex, followed by solid NPK fertilized variants (1 treatment).

❋ In 2007, the determinations pointed out that the stimulating effects of mineral fertilizer treatments on the pigment content (chlorophyllian and carotenoid) in

inflorescences were found under conditions of maintaining a high flavonoid content with protection role.

❋ The number of lavender inflorescences/shrub has increased from the second year crops, respectively the third year of vegetation, to those on the fifth and the sixth year, knowing that the maximum yield in a lavender plantation was reached in the seventh-eighth year of vegetation.

❋ The production of lavender volatile oil has increased from a year of vegetation to another, the very high temperatures of the year 2007 determining the increase in the quantity of volatile oil from lavender inflorescences, reaching 42.2 l/ha in the fourth year crop.

❋ Under conditions of the region of Iaşi, the yield of fresh vegetal matter in balm mint has progressively increased from one vegetation year to another, because of the increase in the number of shoots/plant and therefore, in shrub size.

❋ The production of balm mint volatile oil was higher once with the increase in the yield of fresh plants/ha, the maximum value being obtained in 2007 (12.2 l/ha) at the fourth year crop.

❋ In mint crop, the production of fresh herba has significantly increased from one vegetation year to another (10180 kg/ha in 2007 against 7340 kg/ha in 2006).

❋ The highest quantities of the volatile oil were obtained by the distillation of fresh aerial parts at flowering, both in 2006 (88.2 l/ha) and in 2007 (92.4 l/ha).

❋ The experimental results show that in the Central Moldavia, soil and climatic conditions are favourable to the extension for cropping of the studied crops, assuring both optimum productions of vegetal material and of volatile oils.

❋ The biochemical composition of studied species allows us to recommend the use of these plants for different cosmetics and perfumery preparations