# STUDIES CONCERNING THE PRODUCTION OF VOLATILE OIL, RHIZOMES AND ROOTS, TO DIFFERENT GENOTYPES OF *Valeriana officinalis* L.

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**Abstract.** *Valeriana officinalis* L. is considered to pertain to European species, with great ecologic plasticity, which allows its adaptation to climate conditions characteristics to plain areas and also to mountain areas up to an altitude of 2400 meters. The species is a well-known curative plant, with a long history and multiple uses. Essential oils deriving from this species revealed the interest of researchers in food industry, cosmetics and officinal industry, furthermore being used as additives too.

The raw material from which essential oils are being extracted is represented mainly by rhizomes and roots. This study has the purpose to emphasize the differences of essential oils production registered based upon the genotypes diversity. Thus, 11 experimental variants have been used, with biologic material of different origin, from Romania, Poland, Germany and Russia; they have been measured in relation to their production of rhizomes, roots and volatile oil, in the ecological conditions of Brasov, Romania.

The results proved the superiority of the variants was used Romanian variety M-100, but have also revealed a negative correlation between capacity and essential oil biosynthesis.

**Keywords**: *Valeriana officinalis* L., genotypes, production of roots, analysis of variety

## INTRODUCTION

The therapeutic effect of *Valeriana officinalis* L. species are due to the complexity of chemical compounds biosynthesized by these plants which act for medicinal purposes as an antispasmodic in epilepsy, asthma, flushes [4]. It is a cerebral stimulant; it acts also as an analgesic and in the healing of wounds, ulcers and bruises [9]. Such compounds are also recommended as antidiabetic and installing a good response in reducing polymers [19]. Last studies regarding Valerian's products are concerned upon its use as a sedative [3]. Products from Valerian roots are often used for treating states of nervous irritation caused by over excitement and anxiety disorder [16]. Also, due to its essential oils antimicrobial and antioxidant effects, there is a tendency to use it as natural preservatives, replacing the synthetic ones [14, 22].

Regarding the plant biology, this species is perennial and has the vigorous underground rhizomes, short, cylindrical or stolonifera, yellowish-brown, provided with numerous cylindrical roots [12]. Number of roots may reach 60-70, 20-25 cm in length and a diameter of 2-4 mm. A high-quality extract is derived from the thick roots [4].

The core parts of the white root are bitter-sour taste. The stem is erect, simple, short-hairy in the lower, cylindrical, fistula, hollow high up to 150-200 cm. Leaves are odd-pinnate-sects and flowers are red-lilac to white, small, grouped corimbiforme raceme. It is a proterandric plant regarding anthesis and pollination is cross-fertilized [17].

From roots essential oils are beeing extracted, whose composition has been intensively studied lately [18]. Valerian essential oils are complex mixtures of natural compounds, mostly composed from volatile constituents of this oil like lipids, terpenoids, ketones, phenols and oxygenated derivatives with multiple biological activities such as antimicrobial, insecticidal and antioxidant [5, 6, 21]. Typical biochemical constituents of this oils are Valerie and Isovaleric acid, monoterpenes (α-pinene, α-fenchene, camphene) and monoterpene esters (bornyl-acetate, acetate-myrtenyl, isovaleriate-myrtenyl) [10]. There have also been identified sesquiterpenes, alkaloids, caffeic acid derivatives, valepotriates, flavinoids, lignans and amino acid [7].

As this species is a well vegetating plant in areas with annual rainfall of 650 mm [4] and therefore it is considered appropriate to carry out comparative study culture of *Valeriana officinalis* L. in the Braşov area (Romania), where such ecological and climatic conditions are fulfilled [17]. Furthermore, this specie showed an increased sensitivity to drought in the first year of vegetation, and also during the first part of vegetation of annual cycle.

Rhizome and root production is largely influenced by the origin of biological material and its degree of adaptation to climate conditions which are cultivated [15]. For this reason this study is to emphasize the achievements attained in several varieties, clones or varieties of *Valeriana officinalis* L. brought from various parts of Europe and cultivated into the environmental conditions of Braşov.

## MATERIALS AND METHODS

Biological material was provided by National Institute of Research and Development for Potato and Sugar Beet - Laboratory of Medicinal Plants, Braşov.

Proposed for addressing the objectives of the present study are the use of 11 genotypes which were grouped as follows:

1. approved varieties group - which includes three varieties of *Valeriana officinalis*, created from the process of selection and improvement, with foreign or domestic origin as follows: variety MAGURELE 100 (M-100) - created in the Laboratory of Medicinal Plant

Research Braşov Munk variety - and the variety Polish Polka approved - approved in Poland;

2. group species of the genus *Valeriana*, received from Germany, as follows: *Valeriana collina*, *Valeriana rossica*, *Valeriana wolgensis*;

3. *Valeriana officinalis* clones selected by the group - which includes five clones of a domestic source of the Botanical Garden of Bucharest, respectively *Valeriana officinalis* - 958 and four in Moscow, coded as follows *Valeriana officinalis* - 613, *Valeriana officinallis* - 835; *Valeriana officinalis* - 1102, *Valeriana officinalis* - 982.

The culture was established by direct sowing during autumn, as Bobiț recommended (1997) [4]. The plant was a pre-winter cereal, namely barley, and the land after harvesting was prepared with a 28-30 cm deep plowing. After plowing, the soil was worked with the disc harrow. Harrowing was meant to destroy weeds and maintain moisture in the soil. Seedbed was prepared with a few days before sowing in aggregate harrow disc harrow with adjustable corner. Sowing was done in rows at a distance of 50 cm using 4kg/ha rule. Such low temperatures up to installation, the plants were already in the 2-3 true leaf rosette, which greatly eased since the start of maintenance of vegetation II. In the spring of the second growing season were applied to two hand hoeing and three mechanized weeding. Autumn, with the installation of low temperatures were harvested roots. They were weighed and then passed to a volatile oil extraction by using a Neo Clevenger laboratory equipment [4].

The experiment was monofactorial and was organized by randomized block method [1]. The data were recorded in a table to be subject to interpretation by analysis of variance statistical production of rhizomes and roots and quantity of essential oil obtained [2].

## RESULTS

Yields recorded rhizomes and roots, and volatile oil content of the 11 genotypes used in the present experiment are summarized in Table 1 grouped. Data are statistically and were reported on a variety Romanian registered Magurele - 100. Establishing the significance of differences by comparing the differences between variants and control limit values differences (denoted by DL) calculated the probabilities of transgression of 5%, 1% and 0.1%, for 18 degrees of freedom of error [2]. We are note in Table 1, the significance of differences, with the follow sign [2]:

*- difference is real significant
** - difference is real distict significant
*** - difference is real and verysignificant,
n.s. - difference is neither significant or real,
0 - difference is negative.

Highest level of production of rhizomes and roots, was conducted by the variety Polish Polka 26.2g / pl, followed by Romanian variety Magurele – 100 with 24.4 g / pl. The smallest root mass production was obtained for the variety Polish MUNKA, followed by *Valeriana officinalis* clone - 958, coming from Bucharest Botanical Garden.

Analysis of volatile oil content: the highest amount was obtained for the variety Polish Munk 1.19ml / 100g plant followed by species *Valeriana collina* Walram: MITIDA with 0.94ml / 100g. The Romanian variety Magurele - 100 volatile oil content was 0.84ml / 100g, topping the third place. The small amounts of volatile oil were registered in Moscow in *Valeriana officinalis* clones - 982 containing 0.37ml / 100g and *Valeriana officinalis* – 835 containing 0.34ml / 100g.

**Table 1.** Production of roots and rhizomes and content of volatile oil of *Valeriana officinalis* L. genotypes.

| Nr. crt. | Genotype / source | Rhizome and root production | | | Volatile oil content | | |
|---|---|---|---|---|---|---|---|
| | | g/pl | Difference | Significance | ml/100g | Difference | Significance |
| 1. | Species Măgurele 100 - Romama | 24.4 | - | - | 0.84 | - | - |
| 2. | Species MUNKA-Polonia | 4.9 | -19.5 | 000 | 1.19 | 0.35 | * |
| 3. | Species POLKA-Polonia | 26.2 | 1.8 | n.s. | 0.16 | -0.68 | 000 |
| 4. | *Valeriana rossica* | 9.6 | -14.8 | 000 | 0.63 | -0.21 | n.s. |
| 5. | *Valeriana wolgensis* | 14.3 | -10.1 | 00 | 0.69 | -0.15 | n.s. |
| 6. | *Valeriana collina* | 13.6 | -10.8 | 00 | 0.94 | 0.1 | n.s. |
| 7. | *Valeriana officinalis* - 613 Moscova | 22.6 | -1.8 | n.s. | 0.45 | -0.39 | 0 |
| 8. | *Valeriana officinalis* - 835 Moscova | 12 | -12.4 | 00 | 0.34 | -0.5 | 00 |
| 9. | *Valeriana officinalis* – 958 Bucharest | 6 | -18.4 | 000 | 0.36 | -0.48 | 00 |
| 10. | *Valeriana officinalis* - 1102 Moscova | 13 | -11.4 | 00 | 0.42 | -0.42 | 00 |
| 11. | *Valeriana officinalis* - 982 Moscova | 9.2 | -15.2 | 000 | 0.37 | -0.47 | 00 |
| | **DL 5%** | | 5.78 | | | 0.29 | |
| | **DL1%** | | 7.93 | | | 0.40 | |
| | **DL 0.1%** | | 10.78 | | | 0.54 | |

## DISCUSSIONS

The analysis of variance in the yields obtained from Table 1 points out that in four of the nine genotypes of foreign origin of the differences between mean values, recorded amount of rhizomes and roots are very significantly negative in comparison with Romanian variety Magurele - 100 and the other 4 of the 9 genotypes significant differences are distinctly negative. Only the variety Polish POLKA production of rhizomes and roots is higher than the Romanian variety Magurele - 100, but the differences observed are not significant. In supporting the results obtained in this study there are previous reports published by Bobiț (1997) [4] and Muntean (2007) [11], indicating that they have tried in culture in our country other species too like *Valeriana collina*, *Valeriana rossica, Valeriana wolgensis*, but Romanian variety Magurele - 100 was superior to them in the terms of production and quality.

Analysis of variance, in terms of volatile oil content of a Table 1, shows that the variety Polish MUNKA recorded a significant positive difference in comparison with Romanian variety Magurele - 100. This seems quite interesting because at the Polish plant has obtained the lowest root mass production. Studies published in 2009 by Seidler - Lozykowska Katarzyna (2009) [20] emphasizes superiority in terms of volatile oil content of the variety Polka and importance of harvest period, the ecological conditions of Poland. This, authors say, is recorded in the second century of vegetation. Based on previous reports and those observed in this experiment in the environmental conditions of Braşov, this variety is distinguished by a high efficiency to extract the essential oil. Even though in terms of root, the mass values are not superior, to be drawn MUNKA idea that the variety is a variety that could use improvement in future work to create new forms, better adapted to environmental conditions in our country.

As for the other genotypes, the volatile oil content, five of them have been distinct differences, significantly negative and three genotypes have been no significant difference compared with Romanian variety Magurele - 100. Comparative studies on volatile oil quantity and quality have been made by Huang in 2009 leading to the conclusion that the oil of *Valeriana. officinalis* var. latifolia quantity is different from other species of the genus *Valeriana* [8]. This result is confirmed in the experiment presented in the higher level of volatile oil obtained from *Valeriana collina* in comparison to the Romanian variety Magurele - 100. Although the differences are not significant would be interesting to do a comparative analysis of the quality of oils obtained from different origins.

Analysis results show that in the ecological condition of Brasov, Romanian variety Magurele - 100 recorded higher values in 9 of the 10 genotypes which were compared with a production of 24.4 g / pl root mass. During studies on the establishment of cultivation technology of the species *Valeriana officinalis* L. in 2002 and 2005, in the environmental conditions of Cluj Napoca, published by Muntean, there have been productions of 18-20 g / pl root mass [12, 13]. This can lead us to the idea that the Brasov area can provide a greater suitability for growing the species *Valeriana officinalis* L, due to higher rainfall regime, which would be enhanced by comparative cultures developed over several years.

As a first conclusion, it can be said that Romanian variety Magurele - 100 is a productive and quality variety. The rhizome has a high content of essential oil compared with other varieties but there are possibilities to improve this aspect of the improvement works.

The results obtained in determining sources of germplasm, to improve production capacity and the biosynthesis of essential oil, have once again highlighted the negative correlation between the two elements, emphasizing the weight of creating new varieties characterized by high values of both parameters. This highlights once again that should be sought and used all the levers by which desired performance can be achieve. Research conducted so far have proved once again that solving the problems of improvement of the species *Valeriana officinalis* L. will be using its biological features and wide variability, the species itself puts at our disposal.

As a general conclusion we may add that for Valerian it still wasn't published yet a comprehensive study regarding the volatile oil production and quality variation based on genotype and climate conditions. As a consequence for the future improvement on volatile oils production and quality it is essential to include also the climate and soil factor in order to further otpimize such technologies.

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