

# Genetic resources and phytochemical analysis of medicinal and spices (aromatic) plants in Kaunas Botanical Garden of Vytautas Magnus University

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The results of a study on the genetic resources and phytochemical analysis of medicinal and spices (aromatic) plants are presented in the article. The investigations were conducted at Kaunas Botanical Garden (KBG) and Department of Chemistry of Vytautas Magnus University (VMU) during vegetation periods in 1990–2005. Extensive studies on phenolic compounds, particularly flavonoids, are carried out using capillary electrophoresis (CE) and high efficiency liquid chromatography (HPLC) methods.

**Key words:** medicinal and aromatic plants, phytochemical analysis, genetic resources, Lithuania.

## INTRODUCTION

The document of WHO European Health politics “Health for everyone in 21 century” states that the main aim for governments of all European countries – health for everyone. For the achievement of this aim countries are encouraged to solve two tasks: to preserve and strengthen human health during its all lifetime and to decrease the recurrence of the most frequent diseases. In the law prepared by the EU Parliament, herbs and herbal medicines have been recognized as equals to chemical drugs. This is determined by increasing popularity of phytopreparations [1, 2].

The diversity of medicinal and aromatic plants species and varieties is important from the scientific and practical point of view. At the end of the 20<sup>th</sup> century, specific attention was paid to cultivation and preservation of

medicinal and aromatic plants and to the evaluation of their quality [3]. It is important to increase the assortment of cultivated medicinal plants, to accumulate and study samples of the introduced and acclimatized plants in collections at present and in the future, thus preserving and enriching the genetic fund of useful plants of Lithuania.

**The main** objective of research is the introduction, preservation and phytochemical investigation of medicinal and spices aromatic plants.

## MATERIALS AND METHODS

Research object: medicinal and spices (aromatic) plants, cultivated in collection *ex situ* and their medicinal raw material. The research was performed in 1990-2005 in Central Lithuania (Kaunas), in medicinal, spices (aromatic) and melliferous plants collection *ex situ* at KBG of VMU. The accessions of medicinal and spices plants were studied according to the modified methods for collections and outdoor tests [4, 5]. Investigation results were statistically evaluated by the correlation and regression statistical analysis methods [6]. Statistical analysis of the results was performed using STATENG, ANOVA programs from the software packages Selection and IRRISTAT.

Phytochemical analysis facilities at the Department of Chemistry of Vytautas Magnus University include gas chromatography (GC), high efficiency liquid chromatography (HPLC), capillary chromatography and capillary electrophoresis (CE). For sample preparation different extraction methods including supercritical fluid extraction and solid phase microextraction are used. For evaluation of antioxidant and antiradical properties of the medicinal plant extracts a special HPLC system including reaction detector was built up. As radical reagents 2,2'-azobis-2-amidinopropane dichloride (ABTS) and 2,2-diphenyl-1-picrylhydrazyl hydrate (DPPH) are used [7]. This method provides the possibility to separate complex extracts of the medicinal plants and on-line detect the antioxidant components. Further experiments will be carried out employing electrochemical detection for the comparative evaluation of the reaction detection and electrochemical detection derived data. GC analysis of the essential oils of aromatic plants is used in combination with chemometrics in order to fingerprint and evaluate different forms, varieties, phenotypes and ecotypes of the aromatic plants. The use of supercritical liquid extraction and solid phase microextraction provides a possibility to automate and miniaturize sample preparation of the plants. These methods are compatible with a capillary format separations such as capillary GC, CE and capillary HPLC. In order to increase resolution of the analytical methods new materials such as monolithic adsorbents and multi-dimensional analysis will be used .

Extensive development of the capillary electrophoretic methods for plant analysis is carried out at the Department of Chemistry. The methods of CE include capillary zone electrophoresis (CZE) and micellar electrokinetic capillary chromatography (MEKC), which are very attractive due to the minor sample preparation requirements. Fast scanning UV-visible or diode array detection in the CE equipment available provides additional data for the identification of the separated compounds.

The phytochemical analysis is carried out at different vegetation periods in order to assess the quality of the medicinal plant raw materials and define the raw material collection time for different medicinal plants. Different parts of the medicinal plants are investigated to quantify biologically active substances. Extensive studies on phenolic compounds, particularly flavonoids, are carried out using CE and HPLC methods. The further phytochemical studies will focus on metabolome analysis of the medicinal plants as well as on development of medicinal plant biotechnologies for the industrial purposes.

## RESULTS AND DISCUSSIONS

### **Genetic Resources and Phytochemical analysis of Medicinal, Spices (aromatic) plants in Kaunas Botanical Garden of Vytautas Magnus University.**

At present and in the future it is necessary to enrich the assortment of the cultivated medicinal and spices (aromatic) plants. For this purpose new species are being introduced. Professor Kazys Grybauskas at Kaunas Botanical Garden of Vytautas Magnus University started the introductory study of herbs in 1924 after the foundation of the Department of Medicinal Plants there. It is very important to increase cultivation of medicinal plants in Lithuania because most of these plants serve also as potential genetic resources.

The primary introduction study was carried out on 334 species of medicinal, 110 species of spices (aromatic) and melliferous plants. Perennial plants amount to 70 % from total number of plants, which are grown up in the collection and exposition, biennial plants make up 5 %, annual – 12 %, perennial turned to wood climbing plants and trees come to about 2 %, under shrubs and bushes total to about 4 %. About 90 % medicinal plants grew intensively, under climatic conditions of Lithuania and they passed the whole development cycle successfully. 180 of biennial and perennial medicinal plants wintered very well.

Common harvest of medicinal and aromatic plants was determined in spring, summer and autumn and the content of essential oil in plants and raw materials was established in 48 medicinal plants.

When cultivating medicinal plants we marked a special place of polyphenols of 44 species. The flavonoids (flavonols, anthocyanins et al.) is a big class of polyphenols and they are not only a source of Vitamin P and antioxidants but make a constituent component in a variety of medicines. Flavonol content of higher plants differs from 0.15 to 2.2 % of dry mass and their role in plants is very *multifunctional*. A high content of flavonoids accumulates in *Rhaponticum carthamoides* (DC.) Iljin, *Chamaemelum nobile* (L.) All., *Artemisia dracunculus* L., *A. vulgaris* L., *Hypericum perforatum* L., *Leonurus cardiaca* L., *Origanum vulgare* L., *Polygonum aviculare* L., *Salvia glutinosa* L., *S. officinalis* L., *Scutellaria baicalensis* Georgi, (overground part), *Viola tricolor* L., *Amaranthus cruentus* L., *Filipendula ulmaria* (L.) Maxim., *Geranium macrorrhizum* L. (leaves), *Satureja hortensis* L., *Schisandra chinensis* (Turcz.) Baill. (leaves), *Potentilla fruticosa* L. et al.[7] The highest sum of oxicinnamonic acids (evaluated in cichoric acid) (6.83 %) was determined in the rosette leaves of *Echinacea purpurea* (L.) Moench. The content of cichoric acid in roots of coneflower ranged from 2.65 to 3.48 % [8].

Pigments (carotenoids and chlorophylls a+b) were plenty in the leaves of *Convallaria majalis* L., *Arctium lappa* L., *Leonurus cardiaca* L., *Inula helenium* L., *Calendula officinalis* L. (in inflorescences – to 400.0 mg%), *Hippophae rhamnoides* L. (in fruits – to 60.0 mg%) etc.; ascorbic acid is richly found in *Polygonum aviculare* L. (to 980.0 mg% in dry mass), *Tropaeolum majus* L. (to 500.0 mg%), *Elytrigia repens* (L.) Nevski (to 250.0 mg%), *Capsella bursa-pastoris* (L.) Medik. (to 1.0 % - in flowering grass), *Arctium lappa* L. (in the rosette leaves – to 0.9 % in dry mass) etc.

More substantial content of essential oil was found in *Leonurus cardiaca* L. (to 0.5 % in aerial-dry mass), *Calendula officinalis* L. (to 0.4 %), *Levisticum officinalis* L. (to 1.1 %), species of *Salvia* L. (to 2.7 %), *Tanacetum balsamita* L. (to 2.0 %), *Melissa officinalis* L. (to 1.0 %), *Satureja hortensis* L. (to 2.6 %), *Lavandula angustifolia* Mill. (to 2.2 %), *Angelica archangelica* L. (to 1.2 %), *Agrimonia eupatoria* L. (to 0.7 %), *Perilla frutescens* L., *Dracocephalum moldavica* L., *Anthemis nobilis* L. etc.[8, 9].

## CONCLUSIONS

1. Medicinal and spices (aromatic) plants are sources of raw materials, needed for pharmacy, phytotherapy and are part of genetic resources of Lithuania.

2. Phytochemical investigation of raw material of medicinal, spices (aromatic) plants from collections at Kaunas Botanical Garden of Vytautas Magnus University revealed that new species from foreign and local flora can be successfully introduced and acclimatization in Lithuania.

3. The collection-exposition of Medicinal, Spices (Aromatic) and Mel-

liferous plants of Kaunas Botanical Garden of Vytautas Magnus University is a scientific, education, information and genetic-fund basis for researchers, students, farmers and producers of medicinal and aromatic plants.

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**VAISTINIŲ, PRIESKONINIŲ (AROMATINIŲ) AUGALŲ  
GENETINIAI IŠTEKLIAI IR FITOCHEMINĖ ANALIZĖ  
VYTAUTO DIDŽIOJO UNIVERSITETO KAUNO BOTANIKOS  
SODE**

**S a n t r a u k a**

Tyrimai atlikti 1990–2005 metais Vytauto Didžiojo universiteto Kauno botanikos sode ir Chemijos katedroje. Pastaruoju metu pagamintų ekstraktų iš vaistinės augalinės žaliavos analizei taikomi kapiliarinės skysčių chromatografijos metodai.