

Short Communication

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Production Fields of Peppermint at University of Presov, Slovakia, and their Analyses of Essential Oils for 5 Years

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Abstract

Increasing demands for both crude medicinal plants and natural products based on herbs, the risk of excessive collection from the wild, and more protected areas have led to a growth in small- and large- scale cultivation. It is the only way to supply the contracted volume and high quality of special crop raw material. One of the places in Slovakia where intensive research and development with medicinal plants is carried out is the University of Presov in Presov, Eastern Slovakia. The present agro-technology research & development of medicinal and aromatic plants are concentrated to all aspects of their biodiversity, breeding and cultivation. The Presov university garden contains a number of different herbs: German chamomile (*Matricaria recutita L.*), lemon balm (*Melissa officinalis L.*), marigold (*Calendula officinalis L.*), agrimony (*Agrimonia eupatoria L.*), sage (*Salvia officinalis L.*), hyssop (*Hyssopus officinalis L.*), common mallow (*Malva silvestris L.*), grown for home use and local sales. The objective of this study was the qualitative and quantitative analysis of the essential oil composition in peppermint (*Mentha ×piperita L.*), our variety 'KRISTINKA', grown on the university field. We studied the essential oil composition over last five consecutive years and determined the stability of the chemical composition of the main secondary metabolites in this cultivar.

Keywords: Composition; Essential oil; Eastern Slovakia; Fields; GC/FID; Peppermint

Introduction

The development of the essential oils industry is therefore important to many countries which have rich resources of raw materials or the climatic conditions for the initiation of crop wise cultivation programmes. Though a lot of research has gone into synthetic substitutes for essential oils, the demand for natural oils has not declined but on the contrary it increases. The control of the quality of the raw materials, finished products and of processes is an ab-

solute necessity, if one is to produce goods for world markets and human consumption. The university field with an area of 0.46 hectares at University of Presov in Presov, East Slovakia, belonging to the Department of Ecology, was used mostly for growing vegetables and fruits in previous times. Actually, the objective of our breeding and selection Programme is to deliver the highest marketable yield of the selected medicinal and aromatic plants. In the case of most



major agricultural and horticultural commodities, this generally means achieving the highest possible biomass production coupled with such traits as pest and disease resistance, drought and frost tolerance, and improving the aesthetic quality of the fresh and dry produce. From a large spectrum of plant species, we specialize in herb – peppermint (*Mentha × piperita* L.) for sale to processors in the food, aroma and pharmaceutical industries. As a result of the breeding work at the University of Presov in Presov, Slovakia, was new peppermint variety '*KRISTINKA*', confirmed by a decision at the level of the Community Plant Variety Office (CPVO) in Angers, France in 2017 [1].

Methods

Essential oil from peppermint plants was isolated from dried drugs by repeated hydro-distillation (from 6 to 8 times depending on sample size) and the weight of oil was determined gravimetrically [3]. The modified distillation apparatus by Cooking & Middleton were used. Essential oil content is expressed as percentage and in mg.100 g⁻¹ of drugs. Composition of peppermint essential oils was determined by capillary GC-MSD system on a Varian 450-GC instrument together with a Varian 220-MS with Split-Spitless injection port, MSD detector. Two columns were used: RX-5MS (non-polar), 30 m × 0.25 mm with an inside diameter: 0.25 µm, carrier gas: helium (21 psi) with a flow rate of 1.50 ml.min⁻¹ and a BPX-5MS column (polar), 50 m long with an inside diameter of 0.25 mm and a thickness stationary phase 0.25 µl. Temperature program: 50 °C

- 0 min.; 3 °C.min⁻¹ to 250 °C; 250 °C - 15 min.. Determination of major components of essential oil was realized using the standard compounds, which were supplied by the companies: Extra syntheses, Merck, Fulka and Sigma-Aldrich. Qualitative identification of selected components was carried out by comparison of the retention times of all detected components with the retention time of standard compounds.

Statistical analysis was done by using confidence intervals on the significant level p < 0.05 with our calculation through the mean, standard deviation, and standard error.

Results and Discussion

The major active component of peppermint (*Mentha × piperita* L.) dry herb and leaves is essential oil which content is ranging from 0.5 to 4.0 %. Other compounds found in the peppermint are flavonoids (12%), polymerized polyphenols (19 %), carotenes, tocopherols, betaine and choline [2].

According to the results shown the essential oil content in peppermint leaves grown on the university field reached values between 3.00 ± 0.15 to 3.40 ± 0.25 %.

The chemical profile of the tested essential oils of peppermint essential oil during last 5 years, the identity and the percentage content of the individual components are summarized in Table 1. Essential oil extracted from peppermint variety '*KRISTINKA*', was recorded to have 20 main natural components.

Table 1: Variation in essential oil components of peppermint herb grown on the university field in Eastern Slovakia.

	Qualitative-Quantitative Characteristics of Chamomile Essential Oil [%]				
	2017	2018	2019	2020	2021
Limonene	3.0 + 0.5	3.5 + 0.5	3.5 + 0.5	3.3 + 0.5	3.1 + 0.5
Cineole	0.3 + 0.1	less than 0.2	less than 0.1	0.3 + 0.1	0.2 + 0.1
Menthone	8.3 + 0.5	14.0 + 1.0	17.0 + 1.0	14.0 + 1.0	10.3 + 0.8
Menthofurane	0.3 + 0.1	0.5 + 0.1	0.5 + 0.1	0.4 + 0.1	0.3 + 0.1
Isomenthone	1.7 + 0.1	2.5 + 0.2	2.5 + 0.2	2.4 + 0.2	2.1 + 0.2
Methyl acetate	3.4 + 0.5	2.5 + 0.2	1.2 + 0.2	1.4 + 0.2	0.5 + 0.1
Isopulegol	0.2 + 0.05	less than 0.2	less than 0.1	less than 0.1	0.2 + 0.05
Menthol	74.00 + 3.0	68.00 + 2.0	67.01 + 2.0	71.00 + 2.5	70.00 + 4.0
Pulegone	0.3 + 0.1	less than 0.2	trace	less than 0.2	0.2 + 0.05
Carvone	0.1 + 0.02	0.4 + 0.1	trace	0.4 + 0.1	0.1 + 0.03
Piperitone	0.5 + 0.08	less than 0.2	trace	0.6 + 0.1	0.3 + 0.05

It was found that menthol was the major constituent (from 68.00% ± 2.00 to 74.00 % ± 2.66) followed by menthone (from 8.30% ± 0.5 to 17.00 % ± 1.00), limonene (from 3.0 % ± 0.5 to 3.5 % ± 0.5), iso-menthone (from 1.7 % ± 0.1 to 2.5 % ± 0.2), methyl acetate (from 1.0 % ± 0.5 to 3.5 % ± 0.5), piperitone (> 0.5 %), menthofurane (> 0.5 %), cineole (> 0.3 %), pulegone (> 0.3 %), isopulegol (> 0.5 %), carvone (> 0.5 %).

As can be seen from the chromatographic profile of our mint variety, the main content component of the essential oil is menthol. Menthol ($C_{10}H_{16}$) is a bicyclic monoterpenene chemical compound.

Peppermint has the high menthol content, and is often used as flavoring in tea, ice cream, confectionery, chewing gum, and toothpaste. The oil also contains menthone and menthol esters. It is the oldest and most popular flavor of mint-flavored confectionery [3].

This fact is a much easier way for our country to find new markets. There is an increasing need in the flavor industry for natural isolates that could be substitutes for chemicals. There are not in this case any barriers from the regulation as far as these molecules are already used in the flavor industry or in the cosmetic industry. There is a lack of natural source for several fragrances of flavors.

Conclusion

The introduction of medicinal plants as a part of the agro-technology development on the university field gives an opportunity to cultivate medicinal and aromatic plants with interesting characteristics in Eastern Slovakia. Peppermint oil is among the most important essential oils derived from cultivated plants which are traded on the world markets. The peppermint plant material, the variety 'KRISTINKA' was after five years of testing for varietal diversity, balance and stability showed remarkable results. Our plant population is used in the production of seedlings for large-scale cultivation in Slovakia, but also abroad.

Acknowledgement

None.

Conflict of Interest

No conflict of interest.

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