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SHORT COMMUNICATION

Influence of growing location and variety on the essential oil content of *Melissa officinalis* L. and *Thymus vulgaris* L.

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Abstract

Five lemon balm and four thyme varieties were grown at two locations in open field plots. A significant, however opposite effect of the habitat was detected on the essential oil content of both species. The accumulation of essential oil of lemon balm was superior in Budapest compared to Poznan (means of 0.185 0nd 0.105%, respectively). In thyme, higher contents were produced in Poznan than in Budapest (means of 3.542 and 2.782%, respecitively). The size of the response was not uniform among cultivars. More than three-fold increase was measured in *Melissa officinalis* 'Lorelei' and 'Soroksári'. In case of *Thymus vulgaris*, essential oil content of 'Varico 3', showed largest difference (45%) between the two locations .

Keywords: lemon balm, thyme, habitat, cultivar, environment

Introduction

Lemon balm and thyme are important and popular MAP species widely utilized and processed all over the world. In the practise, the production of these species is going on under diverse ecological conditions. Besides, several selected cultivrs and accessions are already available, however, there are hardly any data on their cultivation value. The goal of our investigation was studying the effect of growing location, as complex environment on these species and their intraspecific varieties.

Materials and Methods

Experimental sites

The experiment was installed at two different growing locations: Budapest (47°54'N, 19°14'E) and Poznan (52°42'N, 16°89'E). Distance in a straight line between these sites is 570 km. Main differences of weather conditions were registered in rainfall (Sum in Poznan 165 mm and in Budapest 330 mm during the season). The temperature was slightly lower in Poznan while among the soil characteristics the largest difference was measured concerning the pH (Table 1.).

Table 1. Marginal temperature values and soil characteristics of the experimental locations

Location	TEMPERATURE (°C)			SOIL						
	minimum	maximum	mean	pH	humus %	NO_3-N (mg/kg)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Ca %	Mg (mg/kg)
Budapest	5.0	35.3	20.2	6.91	2.58	7.73	1260	189	0.51	32.1
Poznan	6.2	34.5	18.5	5.18	0.87	8.46	395	131	1.36	27.4

Plant material

Melissa officinalis L.: Varieties: *'Lorelei', 'Lemona', 'Soroksári', 'Quedlinburger Niederliegende', 'Gold Leaf'*
Thymus vulgaris L.: Varieties '*French Summer', 'Sloneczko', 'Standard Winter', 'Varico 3*'
Seeds were obtained from genebank collections and seedlings raised in greenhouse. Planting of 50-50 seedlings/genotype was carried out at the beginning of June 2014, to a spacing of 40x 25 cm. Sampling happened at the beginning of September by cutting the vegetative shoots above the woodened part in three bulk replications.

Isolation of essential oil

The herb was dried at room temperature, then cleaned and the leaf fraction was investigated. Fifty g of each sample was hydrodistilled for three hours in a Clevenger-type apparatus. The essential oil content was calculated as volume (mL) of essential oil per 100 g of dried weight (three hours, at 105°C).

Results and Discussion

The essential oil content of both species was in the range which is known to be characteristic for the species (Atti-Santos, Pansera, Paroul, Atti-Serafini, & Moyana, 2004; Oniga, Vlase, Toiu, Benedec, & Duda, 2010; Seidler-Lozykowska, Bocianowsky, & Król, 2013; Stahl-Biskup, & Sáez, 2003). However, a large intraspecific variability could be established: there are up to seven fold differences among lemon balm varieties and up to 2.3 fold ones among the thyme accessions (Tables 2 and 3.).
The responses of the two experimental species on the growing habitat concerning essential oil accumulation level were opposite ones. For each lemon balm variety we got a better essential oil content at the plots in Budapest. The increase is 76% as a mean and is significant ($p<0.01$). The largest reactions were found in case of 'Lorelei' and 'Soroksári' varieties where the difference between the two sites exceeded 3 fold. 'Gold leaf' which is an ornamental variety with yelloish leaves surprisingly provided also a relatively good essential oil content but proved to be sensitive to the environment.

Table 2. Essential oil content of five lemon balm varieties from two experimental locations

Varieties	**Budapest**		**Poznan**	
	essential oil (ml/100g)	**coefficient of variation**	**essential oil (ml/100g)**	**coefficient of variation**
Lorelei	0.108[c]	0.080	0.036[c]	0.015
Lemona	0.326[a]	0.105	0.265[a]	0.027
Soroksári	0.136[c]	0.150	0.043[c]	0.100
Quedlinburger	0.217[b]	0.021	0.113[b]	0.020
Gold Leaf	0.132[c]	0.071	0.066[c]	0.013
MEAN	0.185		0.105	

Different letters represent significant differences in the coloumns

Table 3. Essential oil content of four thyme varieties from two experimental locations

Varieties	**Budapest**		**Poznan**	
	essential oil (ml/100g)	**coefficient of variation**	**essential oil (ml/100g)**	**coefficient of variation**
Sloneczko	2.519[b]	0.052	2.523[c]	0.064
French summer	2.185[c]	0.056	3.126[b]	0.071
Varico	3.966[a]	0.067	5.780[a]	0.122

Standard W	2.459[b]	0.062	2.740[c]	0.041
MEAN	2.782		3.542	

Different letters represent significant differences in the coloumns

In thyme, we detected a significant difference ($p<0.01$) between the two growing locations in essential oil accumulation. The plots in Poznan assured higher contents in case of each accession. However, the size of the increase was different, depending on variety. The largest deviation in essential oil content due to the habitat was registered in the Swiss variety 'Varico', which accumulated by 45% higher level in the herb (Table 3.). Also 'French summer' proved to be a sensitive genotype against the environment. Its essential oil content increased by 43%. The varieties 'Standard Winter' and 'Sloneczko' (German and Polish varieties, respectively) responded hardly to the changing environment, their essential oil contents did not changed at the two growing locations. It seems, that phenotypic appearance of the great genetic potential especially of the formerly mentioned varieties depends largely on the growing conditions. The results show, that although common thyme is a species of Mediterranean origin, the selected varieties may assure a good quality drug at appropriate places even in the Northern regions of Europe.

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