

VARIABILITY OF ESSENTIAL OIL CONTENT OF *MENTHA* L. TAXA

J. Neugebauerová, K. Kaffková

Received: September 13, 2012

Abstract

NEUGEBAUEROVÁ, J., KAFFKOVÁ, K.: *Variability of essential oil content of Mentha L. taxa*. Acta univ. agric. et silvic. Mendel. Brun., 2012, LX, No. 8, pp. 187–190

Species of genus *Mentha* L. can be described like herbs with many possibilities to use in industry and pharmacology. The most important product is essential oil. For commercially cultivating of species *Mentha* L. is variability of essential oil content very important characteristic. Variability of essential oil yield of twelve different taxa were monitored for four years. Essential oils were obtained via hydro-distillation and expressed as ml/kg. The highest variability of essential oil content during monitored period showed sample *Pulegium vulgare* and the lowest variability of essential oil content showed *Mentha spicata*.

Mentha L., essential oil content, variability of yield

Spices and herbs have played an important role in people's lives from ancient times to nowadays (Parthasarathy *et al.*, 2008). Species of genus *Mentha* L. are aromatic plants having delightful odour leaves (Chainani, 2010), therefore are grown for two purposes: first, for herbage and essential oil yield (Zeinali *et al.*, 2004) and second, as decorative perennials in gardens (Small, 1997).

Essential oil of *Mentha* L. is product, which have many interesting facilities, for example antibacterial and antioxidant properties (Gulluce *et al.*, 2007). It is known, that essential oil of *Mentha* L. have irreplaceable status in many industries and is widely and mostly used in pharmaceutical, cosmetics, food, flavour, beverage and allied industries (Kassahun *et al.*, 2011; Zeinali *et al.*, 2004; Šalamon *et al.*, 2008). Genus *Mentha* L. including many species, but only four are reported to be cultivated commercially: *Mentha arvensis* L. var. *piperascens* Holmes, *Mentha x piperita* L., *Mentha citrata* L. Erh and *Mentha spicata* (Chand *et al.*, 2004). Most of commercially cultivated mints are hybrids or amphiploids (Sujana and Naidu, 2011) and all genetic improving of *Mentha* L. is focused on higher herbage yield, higher essential oil content and better quality (Zeinali *et al.*, 2004). Yield of essential oil is influenced by many factors, but mainly by genotype, harvesting time and age of plant (Kassahun *et al.*, 2011), and agrotechnics

(Vaverková *et al.*, 1997). The influence of harvesting time was monitored by Hussain *et al.* (2010) who states, that essential oil content of *M. piperita*, *M. longifolia* and *M. spicata* were 12.2, 10.8 and 12.0 g.kg⁻¹ from the summer harvest and 10.5, 7.00 and 9.50 g.kg⁻¹ from the winter harvest.

The goal of this study is determine variability of essential oil content during four year on several taxa cultivated at experimental field at Mendel University, Faculty of Horticulture in Lednice, respectively.

MATERIALS AND METHODS

Plant material

All used plant material were cultivated at Mendel University in Brno, Faculty of Horticulture in Lednice respectively. Plant material were harvested in Jun–July, in stage of full flowering and dried naturally. Then were stored in paper bags in dark place until quantitative analysis. All analysed taxa are presented in Tab. I.

Quantitative analysis

Essential oil was obtained via hydro-distillation according to Czech Pharmacopea 2002, but without xylene. Plant material was milled on laboratory mill (ILABO MF 10 basic, maximally size of grain 3.15

I: List of taxa

Taxa	Supplier	Year of introduction in Lednice
<i>Mentha aquatica</i> 4	BG Praha [CZ]	2003
<i>Mentha longifolia</i> 1	Planta Naturalis [CZ]	2003
<i>Mentha longifolia</i> 2	Jelitto [DU]	2003
<i>Mentha longifolia</i> 'Budleia'	BG Praha [CZ]	2003
<i>Mentha x piperita</i>	Planta Naturalis	2003
<i>Mentha x piperita</i> 'Persephone'	BG Praha [CZ]	2003
<i>Mentha x piperita</i> var. <i>crispa</i>	BG Praha [CZ]	2003
<i>Mentha x piperita</i> var. <i>piperita</i> 'Eau Cologne'	BG Praha [CZ]	2003
<i>Mentha spicata</i>	BG Praha [CZ]	2003
<i>Mentha suaveolens</i> 'Variegata'	BG Praha [CZ]	2003
<i>Pulegium vulgare</i>	Jelitto [DU]	2003

BG – botanical garden

mm). Plant material (20 g) was distilled in 500 ml DH_2O in a 1000 ml flask for 120 minutes. Essential oil content of each taxa was reported in four years (2008–2011). All samples were analysed duplicate and averaged. Essential oil content is expressed as ml/kg dry matter.

Statistical analysis

Significance of variability of essential oil content was evaluated by ANOVA, specifically Two-way between groups ANOVA, using the PC software Statistica CZ v.8 (Stat Soft).

RESULTS AND DISCUSSION

Results of quantitative analysis

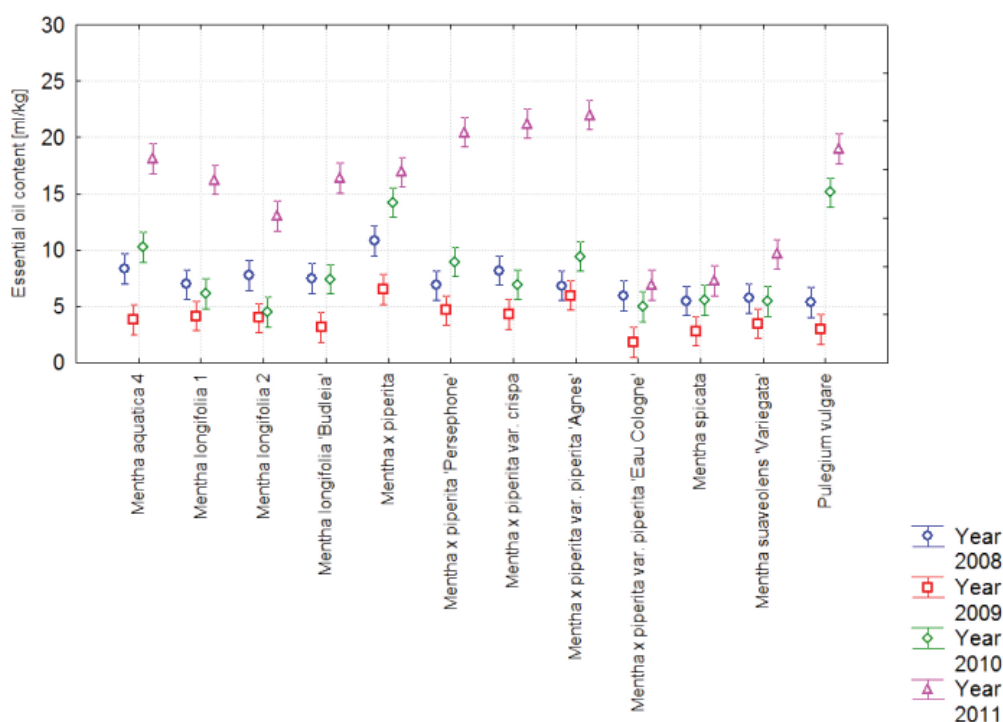
Results of quantitative analysis of all taxa during monitored period (2008–2011) are arranged in Tab. II.

Essential oil content in 2008 ranged between 5.37–10.84 ml/kg and highest content showed *Mentha x piperita* and the lowest content showed *Pulegium vulgare*. In 2009 were contents of essential oils lower in compare with values in year 2008 and ranged between 1.83–6.49 ml/kg, best result showed the same sample as in 2008. *Mentha x piperita*, and the lowest content showed *Mentha x piperita* var. *piperita* 'Eau Cologne'. In 2010 were content higher than in years 2008 and 2009, contents ranged between 4.52–14.24 ml/kg, the highest content showed as usual *Mentha x piperita* and the lowest content showed *Mentha suaveolens* 'Variegata'. In 2011 were reported the highest contents of whole monitored period, ranged between 6.89–21.99 ml/kg, the highest content showed *Mentha x piperita* var. *piperita* 'Agnes', the lowest content showed the same sample as in years 2009, *Mentha x piperita* var. *piperita* 'Eau Cologne'. Statistical analysis confirmed that interaction between year and essential oil content

II: Essential oil content during monitored period 2008–2011

TAXA	AVERAGE 2008	AVERAGE 2009	AVERAGE 2010	AVERAGE 2001
	[ml/kg]	[ml/kg]	[ml/kg]	[ml/kg]
MA 4	8.335	3.833	10.255	18.120
ML 1	6.965	4.167	6.120	16.239
ML 2	7.775	4.000	4.525	13.038
ML 'Budleia'	7.495	3.163	7.439	16.400
MP	10.845	6.499	14.247	16.935
MP 'Persephone'	6.865	4.667	8.970	20.457
MPC	8.205	4.333	6.944	21.230
MPP 'Agnes'	6.845	5.998	9.439	21.993
MPP 'Eau C'	5.950	1.834	4.997	6.897
MS	5.510	2.833	5.579	7.273
MSU 'Variegata'	5.720	3.500	5.495	9.660
PV	5.375	3.000	15.123	18.983

MA 4 – *Mentha aquatica* 4; **ML 1** – *Mentha longifolia* 1; **ML 2** – *Mentha longifolia* 2; **ML 'Budleia'** – *Mentha longifolia* 'Budleia'; **MP** – *Mentha x piperita*; **MP 'Persephone'** – *Mentha x piperita* 'Persephone'; **MPC** – *Mentha x piperita* var. *crispa*; **MPP 'Agnes'** – *Mentha x piperita* var. *piperita* 'Agnes'; **MPP 'Eau C'** – *Mentha x piperita* var. *piperita* 'Eau Cologne'; **MS** – *Mentha spicata*; **MSU 'Variegata'** – *Mentha suaveolens* 'Variegata'; **PV** – *Pulegium vulgare*



1: Variability of essential oil yield during monitored period (2008–2011)

was significant. According to Czech Pharmacopoea 2002 is minimal content of essential oil 8 ml per 1 kg for *Menthae piperitae herba*. In this case *Mentha x piperita* reaches higher essential oil contents than the minimum, with exception in 2009 when the content was very low, only 6.499 ml/kg. But other taxa in 2009 also had low essential oil contents, which may have caused by inappropriate weather conditions.

The most stable content showed *Mentha spicata*, because average of yield deviations in compare with yield average of whole monitored period are only 23.27%, what is obviously visible at Fig. 1. The highest variability of essential oil content showed *Pulegium vulgare*, because average of yield deviations in compare with yield average of whole monitored period are 60.75%.

The most important commercial essential oil-producing species in *Mentha x piperita* (Vaverková *et al.*, 2009). In conclusion we can say, that *Mentha x piperita* is very important species in pharmaceutical, cosmetic a food industry and also is favourite garden

perennial because horticultural firms offer large sortiment of decorative cultivars of *Mentha x piperita*. Tested *Mentha x piperita* samples (*Mentha x piperita*, *Mentha x piperita* 'Persephone', *Mentha x piperita* var. *crispa*, *Mentha x piperita* var. *piperita* 'Eau Cologne'), showed high variability of essential oil content.

In general we can say, that among tested taxa, *Mentha spicata* showed relatively stable essential oil content. *Mentha spicata* has very broad spectrum of uses, but *M. spicata* is not used as decorative plant.

CONCLUSION

The genus *Mentha* L. has very broad spectrum of different taxa and cultivars, which are used for variety of purposes, but content of essential oil is still the most important characteristic. Variability of essential oil content of twelve taxa of *Mentha* L. were monitored for four years, but it is necessary to continue with monitoring to obtain more accurate long-term averages and information about variability.

SUMMARY

Essential oil yield of twelve different taxa *Mentha* L. were monitored for four years and evaluated variability or stability of yield during monitored period for each taxa. Samples of plant material were harvested in stage of full flowering and dried naturally. Essential oils were obtained via hydro-distillation by Clevenger type of apparatus and content was expressed as ml/kg dry matter. Significance was evaluated by ANOVA using the PC software Statistica CZ v.8 (Stat Soft). In 2011 were reported the highest contents of whole monitored period, ranged between 6.89–21.99 ml/kg, the highest content showed *Mentha x piperita* var. *piperita* 'Agnes' and the lowest range was in 2009, ranged between 1.83–6.49 ml/kg and the highest content showed *Mentha x piperita*. The highest variability of essential oil

content during monitored period showed sample *Pulegium vulgare* (60.75% in compare to average of whole monitored period) and the lowest variability of essential oil content showed *Mentha spicata* (only 23.27% in compare to average of whole monitored period).

REFERENCES

- Czech Pharmacopea, 2002: Praha. first edition: Grada. ISBN: 8024704641.
- GULLUCE, M., SAHIN, F., SOKMEN, M., OZER, H., DAFERERA, D., SOKMEN, A., POLLISIOU, M., ADIGUZEL, A., OZKAN, H., 2007: Antimicrobial and antioxidant properties of the essential oils and methanol extract from *Mentha longifolia* L. ssp. *longifolia*. *Food Chemistry*. 103. 4: 1449–1456. ISSN 0308-8146.
- CHAINANI, R., 2010: Comodity special report: medium – term mentha oil view. In: *Moneycontrol: India's no.1 financial portal* [online]. 20th September. 2010 [cit. 2012-06-19]. Dostupné: http://www.moneycontrol.com/news_html_files/broker_report/2010/71200910.pdf.
- CHAND, S., PATRA, N. K., ANWAR, M., PATRA, D. D., 2004: Agronomy and uses of menthol mint (*Mentha arvensis*)-Indian perspective. *Proceedings of the Indian National Science Academy*. B70. 3: 269–297. ISSN 0370-0046.
- HUSSAIN, A. I., ANWAR, F., NIGAM, P. S., ASHRAF, M., GILIANI, A. H., 2010: Seasonal variation in content, chemical composition and antimicrobial and cytotoxic activities of essential oils from four *Mentha* species. *Journal of the Science of Food and Agriculture*. 90. 11: 1827–36. ISSN 0022-5142.
- KASSAHUN, B. M., TEIXEIRA DA SILVA, J. A., MEKONNEN, S. A., 2011: Agronomic characters. leaf and essential oil yield of peppermint (*Mentha piperita* L.) as influenced by harvesting age and row spacing. *Medicinal and Aromatic Plants Science and Biotechnology*. 5. 1: 49–53. ISSN 1752-3389.
- PARTHASARATHY, V. A., CHEMPAKAN, B., ZACHARIACH, T. J., 2008: *Chemistry of spices*. CABI. first edition. ISBN-10: 1845934059. ISBN-13: 978-1845934057.
- SMALL, E., 1997: *Culinary Herbs*. Ottawa, Ontario (Canada): NRC Research Press, 710 p. ISBN 0-660-16668-2.
- SUJANA, P., NAIDU, C. V., 2011: High frequency rapid plant regeneration from shoot tip and nodal explants of *Mentha piperita* (L.) – An important multipurpose medicinal plant. *Journal of Phytology*. 3. 5: 09–13. ISSN 2075-6240.
- ŠALAMON, I., HABÁN, M., HABÁNOVÁ, M., ROSTOKA, L., 2008: Quality of peppermint teas - essential oil content and its compositions. In: *Dovkillja i zdorovja ljudini: Book of Science Papers*, Užgorod: Vidavništvo UŽNU Goverla, 225–229.
- VAVERKOVÁ, Š., MISTRÍKOVÁ, I., HOLLÁ, M., 2009: Qualitative properties of *Mentha x piperita* (L.) after application of the fungicide Hattract DP-50. *Plant, Soil and Environment*. 55. 10: 454–459. ISSN 1214-1178.
- VAVERKOVÁ, Š., HOLLÁ, M., TEKEL, J., HABÁN, M., LABÁT, R., 1997: Effect of fungicide Plantawax 20 EC upon content and composition of *Mentha piperita* (L.) Huds. *Medicinal Plant Report*. 4. 4: 31–34. ISSN 0354-5830.
- ZEINALI, H., ARZANI, A., RAZMJO, K., 2004: Morphological and essential oil content diversity of Iranian mints (*Mentha* spp.). *Iranian Journal of Science & Technology*. 28. A1: 1–9. ISSN 1028-6284.

Address

Ing. Jarmila Neugebauerová, Ph.D., Ústav zelinářství a květinářství, Mendelova univerzita v Brně, Valtická 337, 691 44 Lednice, Česká republika, e-mail: neugebj@zf.mendelu.cz