Macedonian pharmaceutical bulletin, 68 (Suppl 2) 73 - 74 (2022)
Online ISSN 1857 - 8969
DOI: 10.33320/maced.pharm.bull.2022.68.04.031
Short communication

Essential oil quality of peppermint clones established in cultivation in the village of Bavaniste (South Banat, Serbia)

Ana Stević[1], Ljubiša Kolarić[1], Andreja Komnenić[2], Dejan Pljevljakušić[*3]

[1]*University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia*
[2]*University of Montenegro, Biotechnical Faculty, Cetinjski put 2, 81000 Podgorica, Montenegro*
[3]*Institute for Medicinal Plants Research "Dr Josif Pančić", Tadeuša Košćuška 1, 11000 Belgrade, Serbia*

Introduction

Peppermint is one of the most cultivated medicinal plant species in the world. The annual turnover of peppermint raw material exceeds 100,000 tons, and its cultivation area is estimated to be about 4000 ha (FAOSTAT, 2021). However, the quality of the obtained plant raw material largely depends on the climate and growing conditions, but even more important is the assortment. The most commonly grown mint hybrid in the world is *Mentha piperita* which is a sterile multiple hybrid composed of *M. aquatica*, *M. spicata* and *M. longifolia*, while the most commonly grown variety of this hybrid is Black Mitcham.

All species of the genus *Mentha* are rich in essential oils, but they significantly differ in qualitative and quantitative composition. Besides commercially desirable compounds, such as menthol and menthone, significant amounts of undesirable side-product such as menthofuran and its intermediate pulegone may be present in essential oils (Lawrence, 2006). There are also mint hybrids that contain high quantities of linalool/linalyl acetate (e.g., ''Lavanduliodora'').

In this study, we aimed to evaluate the quality of essential oils of varieties of the genus *Mentha* grown in the village of Bavaniste (South Banat, Serbia).

Materials and methods

Plant material

Plant samples were collected from production fields and the private collection of Vlastimir Živkov – Bikin in the early flowering stage. The collected plant samples were i) *M. piperita* var. Black Mitcham, ii) *M. piperita* var. Danica, iii) *M. spicata*, iv) white mint weed (*Mentha* sp.) and v) mint-basil hybrid. The last two species are of unknown botanical origin. All species included in this research are deposited as voucher specimens in the Institute for Medicinal Plants Herbarium collection in Belgrade, Serbia.

Essential oil extraction

Air-dried herbal material was grounded, transferred to a flask, and subjected to distillation on a Clevenger-type apparatus for 2.5 h according to the procedure described in the IV Yugoslavian Pharmacopoeia (Ph. Jug. IV, 1984). The yields of the extracted oils were read volumetrically, and the concentrated oils were collected from the burette of the apparatus with additional drying over anhydrous sodium sulfate. An amount of 20 µL of essential oil was dissolved in 2 mL of ethanol and left in the refrigerator until further analysis.

GC and GC-MS analyses

The chemical profile of the essential oils was determined by analysis on a GC followed by MS analysis of individual peaks. The analyses were performed on a Shimadzu GCMS-QP2010 ultra mass spectrometer fitted with a flame ionic detector and coupled with a GC2010 gas chromatograph, while the InertCap5 capillary column (60.0 m×0.25 mm×0.25 µm) was used for separation. The separation, identification and quantification of volatile compounds were previously described in Drinić et al. (2021).

*dpljevljakusic@mocbilja.rs

Results and discussion

Among tested *Mentha* varieties, Danica had the highest yield of essential oil (2.2 %), while *M. spicata* had the lowest amount (0.8 %). Black Mitcham, mint-basil hybrid, and white mint weed had similar yields of essential oils (1.8 %, 1.9 %, and 1.2 %, respectively). These results are in accordance with the previously published data on essential oil yields in the genus *Mentha* (Ludwiczuk et al., 2016).

The most abundant compounds in essential oil extracted from variety Danica were menthone, menthol and neo-menthol (44.2 %, 26.5 % and 8.7 %, respectively), followed by 1.8-cineole + *cis*-β-ocimene (3.2 %, co-eluted), menthyl acetate (2.6 %), germacrene D (2.5 %) and *trans*-caryophyllene (2.1 %). We were not able to find any reference on var. Danica essential oil composition to support our data. This is the first report for those copmounds in variety Danica.

The essential oil from the Black Mitcham variety had an almost similar profile, where menthone (30.5 %), menthol (31.4 %), and *neo*-menthol (7.1 %) were the most dominant compounds followed by 1.8-cineole + *cis*-β-ocimene (5.5 %, co-eluted) and *cis*-sabinene hydrate (5.0 %). Other accompanying compounds were in the nearly same amount as in the Danica variety (menthyl acetate, 2.6 %; germacrene D, 3.1 %; *trans*-caryophyllene, 2.4 %). Our data on var. Black Mitcham essential oil composition are similar to the previously reported findings of Gholamreza et al. (2019).

The chemical profile of *M. spicata* essential oil was very different compared with the previous two *Mentha* varieties. Here, the most dominant compound was carvone (62.4 %), followed by germacrene D, β-burbonene *trans*-caryophyllene, and limonene (6.6 %, 4.3 %, 3.0 %, and 2.6 %, respectively). These results are in accordance with Snoussi et al. (2015) analysys of *M. spicata* essential oil from Tunisia.

The essential oil from white mint weed had a significantly different profile than previous plant samples, where the most abundant compounds were linalool (50.7 %), trans-piperitone epoxide (20.2 %), and *cis*-sabinene hydrate (8.9 %). Characteristic compounds for mint species such as menthone and menthol were present in lesser amounts (2.5 % and 1.1 %, respectively). A high amount of linalool has been reported in the oils of several *Mentha* hybrids, including *M. aquatica* var. *citrata* (Lawrence, 2006), while abundant piperitone epoxide is characteristic for some *M. spicata* hybrids (Kimbaris et al., 2017). Mint-basil hybrid produced essential oil with a high amount of linalool and geraniol (32.2 % and 30.0 %, respectively). Other accompanying components represented in smaller quantities were 1.8-cineole + *cis*-β-ocimene (9.5 %, co-eluted), elemol (5.6 %) and α-terpineol (4.4 %). Linalool and geraniol are dominant components in Omani basil (Al Abbasy et al., 2015) and therefore this mint-looking species has a closer chemical composition to basil than to mint species.

Conclusion

Among five studied mint varieties, three conventionally cultivated species (B. Mitcham, Danica and *M. spicata*) showed commercially desirable properties of essential oils, while two species (white minth weed and mint-basil hybrid) differed significantly in their chemical composition. Producers should carefully select mint variaties for cultivation in accordance with the desired quality of the raw material, and they should also pay special attention to weed impurities that can significantly impair the quality.

References

Al Abbasy, D.W., Pathare, N., Al-Sabahi, J.N., Khan, S.A., 2015. Chemical composition and antibacterial activity of essential oil isolated from Omani basil (*Ocimum basilicum* L.). Asian Pac. J. Trop. Dis. 5 (8), 645–649.

Drinić, Z., Jovanović, M., Pljevljakušić, D., Ćujić Nikolić, N., Bigović, D., Šavikin K. 2021. Microwave-assisted extraction of essential oil from ginger (*Zingiber officinale* Rosc.), Lekovite sirovine, 41, 22-27.

FAOSTAT. 2021. Statistical Division of the UN Food and Agriculture Organization [http://faostat.fao.org/ Accessed on June 28, 2022]

Gholamreza, A., Majid, S., Seyed, A.S. 2019. Essential oil composition at different plant growth development of peppermint (*Mentha x piperita* L.) under water deficit stress, J. Essent. Oil-Bear. Plants, 22(2), 431-440. https://doi.org/10.1080/0972060X.2019.1581095.

Kimbaris, A.C., González-Coloma, A., Andrés, M.F., Vidali, V.P., Polissiou, M.G., Santana-Méridas, O. 2017. Biocidal compounds from *Mentha* sp. essential oils and their structure-activity relationships. Chem Biodivers. 14(3), PMID: 27770481. https://doi.org/10.1002/cbdv.201600270.

Lawrence, B.M. (Ed.), 2006. Mint: The Genus Mentha (1st ed.). CRC Press

Ludwiczuk, A., Kiełtyka-Dadasiewicz, A., Sawicki R., Golus, J., Ginalska, G. 2016. Essential oils of some Mentha species and cultivars, their chemistry, and bacteriostatic activity. Nat. Prod. Commun. 11(7), 1015-1018. https://doi.org/10.1177/1934578X1601100736.

Ph. Jug. IV, 1984. Pharmacopoea Jugoslavica, 4th edn, Federal Institute of Public Health, Belgrade, Yugoslavia.

Snoussi, M., Noumi, E., Trabelsi, N., Flamini, G., Papetti, A., De Feo, V., 2015. Mentha spicata essential oil: chemical composition, antioxidant and antibacterial activities against planktonic and biofilm cultures of Vibrio spp. strains. Molecules 20(8), 14402-14424. https://doi.org/10.3390/molecules200814402.