Journal of Istanbul Sabahattin Zaim University Institute of Science and Technology
İstanbul Sabahattin Zaim Üniversitesi Fen Bilimleri Enstitüsü Dergisi
https://dergipark.org.tr/en/pub/izufbed

Essential oil and Fatty acid Compounds of Some Endemic Plant Species From Turkey

Ömer Kılıç[a,*], Kağan Kökten[b]

[a] *Adıyaman University, Faculty of Pharmacy, Department of Professional Pharmaceutical Sciences, Adıyaman, Türkiye*
[b] *Bingöl University, Faculty of Agricultute, Department of Field Crops, Bingöl, Türkiye*

Journal of Istanbul Sabahattin Zaim University Institute of Science and Technology (2020) 2 (1): 38-40
DOI: xxxxxx/xxxxxxx

ARTICLE INFO

Article history:

Received: 14 January 2020
Accepted: 17 February 2020
Available online: 30 April 2020

Keywords:

Essential oil
Fatty acid
Origanum
Nepeta
Ballota
Micromaterial

A B S T R A C T

Economically important and endemic plant species have many important uses. In this research essential oil and fatty acid constituents of endemic plant taxa *Origanum acutidens*, *Micromeria elliptica*, *Nepeta congesta* var. *congesta* and *Ballota saxatilis* subsp. *brachyodonta* were analyzed. Detected major compounds as: carvacrol (18.2%), thymol (11.3%) and caryophyllene oxide (7.5%) in *Origanum acutidens*; camphor (12.9%), caryophyllene oxide (12.5%) and pulegone (10.2%) in *Micromeria elliptica*; 1,8-cineole (18.8%) and nepetalactone (14.5%) in *Nepeta congesta* var. *congesta*; β-caryophyllene (11.0%) and pulegone (7.2%) in of *Ballota saxatilis* subsp. *brachyodonta*. Palmitic (31.46%), Steraic (13.22%), Petroselinic (22.22%), Linoleic (9.94%) and Linolenic acid (22.53%) were found to be main fatty acids.

1. Introduction

In chemicals, essential oils obtained especially from medicinal and aromatic plants and these important seconder metabolites have many useful effects in alive life. Most of Lamiaceae (Labiatae) member have antioxidants, antimicrobial, antibacterial and other biological activities. In addition, Lamiaceae taxa have economic importance in food, medicine, pharmaceutical industries and in ethnobotany. In Turkish ethnobotany most of Lamiaceae taxa are often used for the treatment of many diseases. Essential oils shows antioxidant, antimicrobial, antibacterial, antidiabetic, antimutagenic, antifungal, non-toxigenic, preservative for foods, anti-inflammatory, antiviral and sedative effects (Nakatsu et al., 2000). Plants protects itself by essential oils against fungi, bacteria, viruses, herbivores, defence against insects; because of essential oils plants have allelopathic activity and attracted pollinators to dispersion of seeds and pollens (Raybaudi-Massilia et al., 2009). Lamiaceae family consists of about 252 genera and more than 6700 taxa and in the world; in Turkey Lamiaceae with 46 genera, 782 taxa comprising of which 346 taxa are endemic and endemism ratio is ca. 44% (Celep and Dirmenci, 2007). Some *Micromeria* taxa are used in ethnobotany for stomach pains, digestive, relieve headache, capillary tonic, bathing inflamed, sore eyes, abdominal pains and hypertension (Rivera and Obon, 1992). Some *Micromeria* taxa have antimicrobial, antifungal and other biological activity (Duru et al., 2004). In Turkey aerial parts of some *Ballota* taxa are used to treat inflammation, as an antiseptic for wounds, against gastrointestinal disorders and antiseptic, anti-inflammatory, anti-rheumatic, antioxidant, antimicrobial effects; *Nepeta* L. taxa are pharmacological and biological effects and this attributed to nepetalactones in *Nepeta* (Yeşilada et al., 1993). Origanum taxa also have antibacterial, antioxidant, carminative, antispasmodic, antifungal, antimicrobial and analgesic effects (Gottumukkala et al., 2011).

However, there is lack study about essential oil and fatty acid composition of studied taxa in the literature. With this study, essential oil and fatty acid composition leaves of endemic plants *Origanum acutidens*, *Micromeria elliptica*, *Nepeta congesta* var. *congesta*, *Ballota saxatilis* subsp. *brachyyodonta* were detected to contribute literature and chemical data of studied taxa.

2. Material and Method

2.1 Plant Materials

Origanum acutidens was collected from Topalan village (Bingöl) roadside, steppe and rocky areas, in June 2018, 1200-1300 m., by O. Kilic with 6880 collected number. *Ballota nigra* subsp. *saxatilis* was collected from Arsuz (Hatay) district, South of Tülek waist, foresty areas, in June 2017, by O. Kilic with 5726 collected number. *Micromeria elliptica* was collected from upper part of Alatepe village (Bingöl), vicinity of Kale-bulakbaşı, rocky areas, in June 2017, 1800-1900 m., by O. Kilic with 5680 collected number.

* *Corresponding author.*
E-mail address: omerkilic77@gmail.com (Ömer Kılıç)

Nepeta congesta var. *congesta* was collected from Zara, Halkalı ve Korkut köyleri karşısı, bozkır, taşlık, jipsli tepe, bayır, orman açıklığı, 1400-1500 m, 20.06.2017, by O. Kilic with 5720. Plant samples were identified with Flora of Turkey of volume seven (Davis, 1982). Voucher specimens were deposited in the Pharmacy Faculty of Adıyaman University.

2.2 GC-MS Analysis

5 g of the each plant samples were homogenized in 10 mL of hexane/isopropanol at 10.000 rpm for 30 second and centrifuged at 5000 rpmfor 10 min. Derivatization with methyl esters is often preferred. Forthispurpose Christiemethod was used (Christie, 1990). This mixture was kept at 50 ^{0}C for 15 hours of methylation. The solvent of the mixture containing the methyl esters was then evaporated at 45°C under nitrogen and the fatty acids below the test tubes were dissolved in 1 mL of hexane and analyzed by GC-MS using amber GC vials. The essential oils were analyzed using HP 6890 GC equipped with and FID detector was used. An Agilent brand 7890A / 5970 C GC-MS instrument and a SGE Analytical BPx 90 100m x 0.25 mm x 0.25 um column were used for fatty acid analysis. The temperature program was gradually heated from 100 ^{0}C to 240 ^{0}C and the total time was set to 40 min. Injection volume was 1 uL and split ratio was 10: 1, solvent delay time was 12 minutes, carrier gas was He. The analiyzes were carried out in central laboratuary of Bingol University. The essential oil compounds were identified using the Wiley and Nist mass spectral library and the identified compounds of the essential oils are listed in Table 1. The identified fatty acid compounds of studied taxa are listed in Table 2.

Table 1. Essential oil compounds of studied samples (%)

Compounds	**RRI**	***O. acutidens***	***M. elliptica***	***N. congesta* var. *congesta***	***B. saxatilis* subsp. *brachyodonta***
α-pinene	1023	6.8	4.5	4.1	3.2
Camphor	1025	6.2	**12.9**	4.6	-
Pulegone	1035	-	**10.2**	1.2	**7.2**
β-pinene	1050	2.7	6.7	5	3.8
β-myrcene	1065	-	0.2	4.6	2.2
α-Phellandrene	1075	0.6	-	-	4.1
δ-3-carene	1080	-	1.3	3	-
α-terpinene	1085	2.1	-	2.5	5.4
p-cymene	1090	0.7	1.2	-	3.2
1-8-cineole	1096	8.7	3.8	**18.8**	5.7
β-ocimene	1105	0.3	-	0.9	2.9
γ-terpinene	1120	1	1.7	-	3.4
Borneol	1175	1.8	-	1.8	0.2
α-terpineol	1210	0.3	1.2	-	5.8
α-terpinolen	1215	1.1	3.6	-	0.4
Carvacrol	1235	**18.2**	3.2	0.9	-
Bornyl acetate	1252	7.2	3	-	2.3
Thymol	1295	**11.3**	5.4	1.8	-
Nepetalactone	1320	-	0.1	**14.5**	3.2
α-cubebene	1325	0.1	-	0.4	5.5
α-copaene	1365	0.5	1.3	0.7	1.5
β-bourbenene	1370	-	0.6	1.2	1.1
β-caryophyllene	1375	0.5	-	0.7	**11**
β-cubebene	1385	-	1.2	-	0.5
α-humulene	1415	0.4	-	1	1.2
Germacrene D	1430	3.6	0.4	2.3	2.7
β-selinene	1445	4.1	8.5	-	-
α-amorphene	1455	-	1.2	0.5	3.8
δ-cadinene	1465	2.4	1.5	5.7	1.6
Spathulenol	1485	-	0.8	5.8	0.7
Caryophyllene oxide	1495	**7.5**	**12.5**	3.4	4.6
Total		**89.1**	**87.1**	**89**	**87.2**

Table 2. Leaf fatty acid composition of studied samples (%)

Samples	Palmitic	Palmitoleic	Stearic	Petroselinic	Linoleic	Linolenic	Arasidic	Eicosatrienoic	Behenic
M. elliptica	17.9	-	8.1	22.5	15.4	32.4	1.1	1	1.8
B. saxatilis subsp. brachyodonta	30.1	2.6	13.4	31.4	8.7	13.7	-	-	-
N. congesta var. congesta	40.5	-	14.7	14.4	5.9	24.5	-	-	-
O. acutidens	37.4	-	16.6	20.6	9.8	15.6	-	-	-

3. Conclusion

In conclusion, qualitative and quantitative variations depending on collection time, environmental factors, climatic factors, drying conditions, mode of distillation, genetic, season, plant part analyzed, ontogeny, analytical methods or defence and protection from insects, animals or pathogens. The findings showed that the studied plant taxa had some variations in fatty acid and essential oil composition. In the literature there is lack study about fatty acid composition of endemic species *Origanum acutidens, Micromeria elliptica, Nepeta congesta* var. *congesta* and *Ballota saxatilis* subsp. *brachyodonta;* so this study also contribute to fatty acid composition of *Origanum, Micromeria, Ballota* and *Nepeta* taxa.

References

Celep, F., & Dirmenci, T. (2017). Systematic and Bio-geographic Overview of Lamiaceae in Turkey. *Natural Volatiles and Essential Oils, 4,* 14-27.

Christie, W.W. (1990). Gas Chromatography and Lipids: A Practical Guide. *The Oily Press,* 307.

Davis, P.H. (1982). Flora of Turkey and East Eagean Island: *Edinburgh University Press.,* 7.

Duru, ME., Öztürk, M., Ugur, A., & Ceylan, Ö. (2004). The essential oil and in vitro antimicrobial activity of Micromer cilicica from Turkey. *Journal of Ethnopharmacology, 94,* 43-48.

Fraternale, D., & Ricci, D. (2014). Essential oil composition and antifungal activity of aerial parts of Ballota nigra ssp. foetida collected at flowering and fruiting times. *Natural Product Communications, 9,* 1015-1018.

Gottumukkala, V.R., Mukhopadhyay, T., Annamalai, T., Radhakrishnan, N., & Sahoo, M.R. (2011). Chemical constituents and biological studies of Origanum vulgare. *Pharmacognosy Research, 3,* 143-145.

Kılıç, O., & Özdemir, FA. (2016). Variability of Essential Oil Composition of Origanum vulgare Populations from Turkey. *Journal of Essential Oil Bearing Plants, 19,* 2083-2090.

Kilic, O., Behcet, L., & Bagci, E. (2013). Essential oil compounds of three Nepeta L. Taxa From Turkey, and Their Chemotaxonomy. *Asian Journal of Chemistry, 25,* 8181-8183.

Marinkovic, B., Marin, P., Knezevic, Vukc˘evic DJ., M.D. Sokovic., & Brkic, D. (2002). Activity of Essential Oils of Three Micromeria Species (Lamiaceae) Against Micromycetes and Bacteria. *Phytotheraphy Research, 16,* 336–339.

Nakatsu, T., Lupo, A.T., Chinn, JW., & Kang, R.K.L. (2000). Biological activity of essential oils and their constituents. *Natural Product Chemistry, 21,* 571–63.

Raybaudi-Massilia, RM., Mosqueda-Melgar, J., Soliva-Fortuny, R., & Martín-Belloso, O.(2009). Control of pathogenic -spoilage microorganisms in fresh-cut fruits and fruit juices by traditional natural antimicrobials. *Compr Food Science Food Safety, 8,*157–180.

Rivera, N., & Obon, C. (1992). Ethnobotany of old world Labiatae. *Royan Bot Gardens,* 437-454.

Semnani, KM., Saeedi, M., & Akbarzadeh, M. (2007). The essential oil composition of Ballota nigra. *Chemistry of natural compounds, 43,* 722-723.

Tabanca, N., Kirimer, N., Demirci, B., Demirci, F., & Baser, KHC. (2001). Composition and antimicrobial activity of the essential oils of Micromeria cristata and the enantiomeric distribution of borneol. *Journal of Agricultural and Food Chemistry, 49,* 4300–4303.

Yeşilada,E., Honda, G., Sezik, E., Tabata, M., Goto, K., & Ikeshiro, Y., (2004). Traditional medicine in Turkey. IV. Folk medicine in the Mediterranean subdivision. *Journal of Ethnopharmacology, 39,* 31-38.