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VARIATION IN ESSENTIAL OIL CONTENT AND COMPOSITION OF SOME MEDICINAL AND AROMATIC PLANTS AVAILABLE ON TURKISH MARKET

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Abstract

Interest on medicinal and aromatic plants has increased during recent years as they are sources of many bioactive compounds, like essential oils, having versatile pharmacological and medicinal properties. Medicinal and aromatic plants are mostly collected from nature in Turkey and thus chemical composition of essential oils of herbal drugs available in markets is expected to be variable. In this study, variation in essential oil content and composition of eucalyptus, laurel, myrte and yarrow plant samples obtained from spice shops in Ordu province of Turkey were investigated. Essential oil contents of the plant samples were determined by water distillation and essential oil components were analyzed by GC/MS. Essential oil contents were within the ranges of 0.80-2.15% in eucalyptus, 1.55-2.85% in laurel, 0.65-1.40% in myrte and 0.25-0.45% in yarrow. A total of 26 components in eucalyptus and yarrow essential oils, 22 components in laurel and myrte essential oils were detected, representing 95.88-97.05% of the essential oils. Eucalyptol (61.53%), terpinyl acetate (7.90%) and sabinene (5.03%) in laurel; eucalyptol (48.06%), p-cymene (16.70%) and cyclopropeazulen (5.66%) in eucalyptus; eucalyptol (30.87%), a-pinene (28.23%) and linalol (8.27% in myrte, and eucalyptol (32.05%), camphor (11.09%) and carvacrol (9.27%) in yarrow were the major constituents of the essential oil. Eucalyptol was found to be the most common and the highest chemical constituent of the essential oils.

Key words: *eucalyptus, laurel, myrte, secondary metabolite, volatile oil, yarrow.*

INTRODUCTION

Being a bridge between South Europe and Southeast Asia and located on the intercrossing point of three phyto-geographic regions, Anatolia is one of the richest regions of the world in terms of plant biodiversity. It has been stated that the flora of Anatolia includes almost 12 thousands plant species, and nearly one third of them are endemic (Kahraman et al., 2012).

Medicinal and aromatic plants are of significant importance in the plant diversity of Anatolia which has quite different climatic and ecological conditions. Turkey is among the richest countries especially in respect to medicinal and aromatic plants collected from nature as well (Baser, 2002).

The curative and aromatic properties of medicinal and aromatic plants are due to the presence of complex chemical substances, called secondary metabolites. Volatile oils, one the most important secondary metabolites found in medicinal and aromatic plants, are commonly used as a source of medicine, food, perfume and cosmetics. Recent researches revealed that volatile oils have a strong antioxidant and antimicrobial effect (Özcan and Erkmen, 2001; Bakkali et al., 2008).

Bioactive compounds synthesized in medicinal and aromatic plants may wary significantly according to used plant part, plant growth stage and harvest time etc. The highest essential oil present in leaves of certain plants, but in flowers of others. Growing period in which essential oils present at the maximum is full blooming in general. Ecological conditions, production technologies and postharvest operations play positive or negative effects on the amount and quality of bioactive compounds as well. The most important factor that determines the importance and economic value of essential oilsis the amount and variety of chemical constituents that forms essential oil. The amount and chemical composition of essential oils obtained from different plant parts, at different growth stages and at diverse ecologies may fluctuate greatly (Azizi and Kahrizi, 2008; Uyanik et al., 2010).

Although Turkey has a great potential for medicinal and aromatic plants, most of the plant drugs exported and used in traditional public health are composed of plants collected from natural habitat (Özek et al., 2000). The first hand source providing plant drugs are spice shops (Aktar in Turkish) which are of considerable importance in traditional folk medicine in Anatolia for ages. Since medicinal and aromatic plants are mostly collected from nature in Turkey, content and constituents of essential oils of herbal drugs sold in spice shops are likely to be considerable variable. This study was carried out to determine content and chemical composition of volatile oils of certain medicinal and aromatic plants obtained from spice shops in Ordu province of Turkey.

MATERIALS AND METHODS

Plant materials of four species were obtained in October 2009 from local spice shops in Ordu province in the Black Sea Region of Turkey. The plant species were: eucalyptus (*Eucalyptus globules*), laurel (*Laurus nobilis),* myrte *(Myrtus communis*) and yarrow (*Achillie millefolium*). For chemical analysis, four different samples of 100 g from each of the four species were obtained from local spice shops. The essential oil content was determined separately using a Clevenger-type apparatus. The samples were distilled for 3 h in 500 ml water. The essential oil was analyzed by GC-MS. The essential oil was analyzed using HP 6890 GC equipped with and FID detector and also oils were analyzed by GC-MS, using a Hewlett Packard system. HP-5 MS column (30 m x 0.25 mm i.d., film thickness 0.25 µm) was used with Helium as the carrier gas. Injector temperature was 250^{o}C, split flow was 1 ml / min. The GC oven temperature was kept at 70^{o}C for 2 min. and programmed to 150^{o}C at a rate of 10^{o}C / min and then kept constant at 150^{o}C for 15 min to 240^{o}C at a rate of 5^{o}C / min.

RESULTS AND DISCUSSIONS

Essential oils and the most important five constituents observed in the plant samples available on the markets of Ordu province are summarized in Table 1-5. Essential oil contents were within the ranges of 0.80-2.15% in eucalyptus, 1.55-2.85% in laurel, 0.65-1.40% in myrte and 0.25-0.45% in yarrow (Table 1). A total of 26 components in eucalyptus and yarrow essential oils and 22 components in laurel and myrte essential oils were detected by GC/MS analysis, representing 95.88-97.05% of the essential oils.

Table 1. Essential oil contents (%) of plant samples obtained from spice shops in Ordu province of Turkey

Plant name	Plant Samples				
	1	2	3	4	Mean%
Eucalyptus	0.85	0.80	2.15	1.75	1.38
Laurel	2.25	1.55	--	2.85	2.22
Myrte	1.40	0.65	1.20	0.95	0.78
Yarrow	0.40	0.40	0.25	0.45	0.37

Eucalyptol (48.06%), p-cymene (16.70%), cyclopropeazulen (5.66%), ß-phellandrene (5.13%) and cryptone 4.09%) were detected as the main components in eucalyptus samples, comprising the 79.64% essential oil (Table 2). In a previous study, 1, 8-eucalyptol (72.71%), a-pinene (9.22%) and a-terpineol (2.54%) were determined as the main components of eucalyptus essential oil (Song et al., 2009).

Table 2. Essential oil composition (%) of eucalyptus available in spice shops in Ordu province of Turkey

	Plant Samples			
Components	1	2	3	Mean%
Eucalyptol	30.74	52.99	49.65	58.86
p-cymene	20.52	28.4	5.44	12.46
Cyclopropeazulen	7.86		8.77	0.35
ß-phellandrene	5.30	3.38	5.62	6.23
Cryptone	9.05	3.18	2.54	1.62

In the essential oils of laurel, major compounds (Table 3) were found as eucalyptol (61.53%), terpinyl acetate (7.90%), sabinene (5.03%), a-pinene (3.76%) and 4-carvomenthenol (3.68%), comprising 81.90% of the essential oil.

Ozcan and Chalchat (2005) studied the essential oil components of *Laurus nobilis* gathered from seven different locations of Turkey. Among the major components were 1,8-cineole (51.73-68.48%), a-terpinyl acetate (4.04-9.87%), sabinene (4.44-7.75%), a-pinene (2.93-4.89%) and ß-pinene (2.58-3.91%). Minor qualitative and major quantitative variations of some compound, were determined with respect to localities.

In the study of Verdian-rizi (2009), the essential oilsobtained from the different

phenological stages were found to have similar compositions. The main compounds were 1,8-cineole, sabinene, a-terpinylacetate, methyl eugenol, and a-Pinene. The time of harvesting did not show a major effect on the composition of essential oil. Flowering stage was the best time for harvest because at this time the plant contained the highest percent of essential oil.

Table 3. Essential oil composition (%) of laurel available in spice shops in Ordu province of Turkey

	Plant Samples			
Components	1	2	3	Mean%
Eucalyptol	66.89	67.63	50.07	61.53
Terpinyl acetate	6.45	4.91	12.35	7.90
Sabinene	3.68	3.41	8.00	5.03
a-pinene	3.08	3.43	4.79	3.76
4-carvomenthenol	4.50	3.25	3.30	3.68

The major constituents of myrte essential oil were eucalyptol (30.87%), a-pinene (28.23%), linalool (8.27%), limonene (6.43%) and a-terpineol (5.61%), as shown in Table 4. The first five components comprised the 79.41% of the essential oil of myrte.

Table 4. Essential oil composition (%) of myrte available in spice shops in Ordu province of Turkey

	Plant Samples				
Components	1	2	3	4	Mean%
Eucalyptol	43.94	26.29	22.52	30.74	30.87
a-pinene	24.31	21.03	33.81	33.77	28.23
Linalool	4.61	10.72	9.27	8.51	8.27
Limonene	5.54	9.64	2.92	7.62	6.43
a-terpineol	7.32	5.54	4.28	5.30	5.61

The composition of essential oils from leaves and leaves + branches (collected from Mugla and Balikesir provinces of Turkey) of Myrtus communis was examined by GC/MS (Özek et al., 2000). The main components were 1.8-cineole (eucalyptol) (18.2% and 10.5% in leaves and leaves + branches, respectively), linalool (16.3% and 18.6%) and myrtenyl acetate (14.5% and 10.8%). Wannes et al. (2009) found eucalyptol (7.31-40.99%), geranyl acetate (1.83-20.54%), linalool (0.74-18.92%) and a-pinene (1.24-12.64%) as the major compounds of essential oils of myrte.

Twenty-six compounds were identified in essential oil of yarrow and constituted 95.90-98.27% of the total oil. Eucalyptol (32.05%), camphor (11.09%), carvacrol (9.27%), eugenol (6.60%) and carvone (6.53%) were detected as the main components of eucalyptus essential oil (Table 5). Candan et al. (2003) reported that the essential oil of yarrow was characterized by a high number of monoterpenes. They found that eucalyptol (24.6%), camphor (16.7%), a-terpineol (10.2%), ß-pinene (4.2%), and borneol (4.0%) were the principal components comprising the 59.7% of the essential oil.

Table 5. Essential oil composition (%) of yarrow available in spice shops in Ordu province of Turkey

	Plant Samples				
Components	1	2	3	4	Mean%
Eucalyptol	35.99	24.45	34.44	33.32	32.05
Camphor	7.52	10.49	12.21	14.16	11.09
Carvacrol	5.36	17.9	13.0	0.82	9.27
Eugenol	3.04	15.9	5.45	2.26	6.66
Carvone	--	2.33	2.54	14.73	6.53

CONCLUSIONS

In the present work, the contents of essential oils ranged between 0.80 to 2.15% in eucalyptus, 1.55 to 2.85% in laurel, 0.65 to 1.40% in myrte and 0.25 to 0.45% in yarrow. A total of 22 constituents of theessential oil from laurel and myrte and 26 components of the essential oil from eucalyptus and yarrow were determined. The major constituents in the essential oils were similar to those reported in the literature, with some differences in the percentage composition. Eucalyptol was found to be the most common and the highest chemical constituent of the essential oils.

REFERENCES

Azizi K., Kahrizi D., 2008. Effect of nitrogen levels, plant density and climate on yield quantity and quality in cumin (*Cuminum cyminum* L.) under the conditions of Iran. Asian J. Plant Sci., 7, p. 710-716.

Bakkali F., Averbeck S., Averbeck D., Idaomar M., 2008. Biological effects of essential oils – A review. Food and Chemical Toxicology, 46 (2), p. 446-475.

Baser H. C., 2002. Aromatic biodiversity among the floweringplant taxa of Turkey. Pure Appl. Chem., 74 (4), p. 527–545.

Candan F., Unlu M., Tepe B., Daferera D., Polissiou M., Sökmen A., Akpulat H. A., 2003. Antioxidant and antimicrobial activity of the essential oil and methanol extracts of *Achillea millefolium* subsp. *millefolium* Afan. (Asteraceae). Journal of Ethnopharmacology, 87, p. 215–220.

Kahraman A., Onder M., Ceyhan E., 2012. The importance of bioconservation and biodiversity in Turkey. International Journal of Bioscience, Biochemistry and Bioinformatics, 2 (2), p. 95-9.

Özcan M., Erkmen O., 2001. Antimicrobial activity of the essential oils of Turkish plant spices. Eurepean Food Research Technology, 212, p. 658-660.

Özcan M., Chalchat J.C., 2005. Effect of different locations on the chemical composition of essential oils of laurel (*Laurus nobilis* L.) leaves growing wild in Turkey. J Med Food, 8 (3), p. 408-411.

Özek T., Demirci B., Baser K. H. C., 2000. Chemical composition of Turkish myrtle oil. Journal of Essential Oil Research, 12 (5), p. 541-544.

Song A., Wang Y., Liu Y., 2009. Study on the chemical constituents of the essential oil of the leaves of *Eucalyptus globules* Labill from China. Asian Journal of Traditional Medicines, 4 (4), p. 134-140.

Uyanik M., Kara S. M., Kandemir K, Ipek A, Gürbüz B., 2010. Volatile Oil and its Components in Coriander as Affected by Row Spacing and Nitrogen. 6th Conference on Aromatic and Medicinal Plants of Southeast European Countries (6th CMAPSEEC), 18-22 April 2010, Antalya, Turkey.

Wannes W.A., Mhamdi B., Marzouk B., 2009. Variations in essential oil and fatty acid composition during *Myrtus communis* var. *italica* fruit maturation. Food Chemistry, 112, p. 621–626.

Verdian-rizi M., 2009. Variation in the essential oil composition of *Laurus nobilis* L. of different growth stages cultivatedin Iran. Journal of Basic and Applied Sciences, 5 (1), p. 33-36.