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Comparison of chemical composition of the essential oil of *Laurus nobilis* L. leaves and fruits from different regions of Hatay, Turkey

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Abstract: *The essential oils of the leaves and fruits from bay (Laurus nobilis L.) grown in Antakya, Yayladagi and Samandagi were isolated by solvent extraction and analysed by capillary gas chromatography (GC), gas chromatography and mass spectrometry (GC/MS). In Antakya, Yayladagi and Samandagi the chemical compositions of the fruits and leaves were similar according to qualitative and quantitative analysis. Although in both fruits and leaves the major component was found to be 1.8-Cineole a concentration of about 50% compared with essential oils. The composition of the essential oil from the leaves has high content of 1.8-Cineole, Sabinene and α-Terpinyl acetate, but a low content of α-Pinene, α-Phellandrene and trans-β-osimen. 1.8-Cineole was found major component of the leaves essential oil collected from Samandagi (59.94%) which is sea coast of region. Interestingly, α-Pinene, β-Pinene, α-Phellandrene, 1.8-Cineole and trans-β-osimen were found the major components of fruits of Laurus nobilis L. harvested from Antakya, Yayladagi and Samandagi. Trans-β-osimen was detected as the major component of fruits essential oil collected again from Samandagi (28.35%)*

Key words: *Laurus nobilis L., Essential oil, GC, GC/MS, Antakya-Hatay, Turkey*
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Introduction

Laurus nobilis L. belongs to the family Lauraceae, which comprises numerous aromatic and medicinal plants (Hogg *et al.*, 1974). *Laurus nobilis* L. native to Mediterranean regions is also known as sweet bay, bay laurel, Grecian laurel, true bay, and bay. The dried leaves are used extensively in cooking, and the essential oil is generally used in the flavourings industry (Bauer and Garbe, 1985). Laurel essential oil, also called laurel leaf oil or sweet bay essential oil, is also used for the preparation of hair lotion due to its antidandruff activity and for the external treatment of psoriasis. *Laurus nobilis* L. fruits are generally utilized for the production of perfumed soaps and candle manufacture because of their fatty acid content (Hafizoglu and Reunanen, 1993). The essential oil of leaves has antibacterial and antimicrobial properties (Knobloch *et al.*, 1989; Ozcan and Erkmen, 2001). Different studies made on the essential oil show influence of the area of culture, of variety and harvest season on the chemical composition (Rohloff *et al.*, 2005; Flamini *et al.*, 2007). 1.8-Cineole has been identified as the major component of many plant essential oil as well as *Laurus nobilis* L. (Fiorini *et al.*, 1997; Dadalioglu and Evrendilek, 2004), but relatively little is known about their biological activities. It has been reported that the chemical composition of essential oil of leaves, stem and fruits are different from each other to some extent (Fiorini *et al.*, 1997).

In Turkey, *Laurus nobilis* L. grows in the Marmara, Aegean and Mediterranean regions (Müller-Riebau *et al.*, 1997; Digrak *et al.*, 2001; Kilic *et al.*, 2004; Tilki, 2004). As far as our literature survey could ascertain, a comparison of the chemical composition of the essential oil obtained from *Laurus nobilis* L. grown in various region of Hatay have not previously been published, although there are some reports of the compositions of the essential oil obtained from different parts of Turkey (Muller-Riebau *et al.*, 1997; Kanat and Alma, 2004) Particularly, in Hatay homemade production and use of essential oil of *Laurus nobilis* L. is quite common. Wild growing *Laurus nobilis* L. trees are found in Antakya, Yayladagi and Samandagi. These three towns have different geographic and climatic situations. Antakya is located at the side of river Orontes and about 25 km far from the Mediterranean sea, Yayladagi is a highland located on the range of Yayladagi mountain and Samandagi is situated on the eastern coast of the Mediterranean sea. The aim of the current study was to determine and compare the leaves and fruits of essential oil of *Laurus nobilis* L. collected from three naturally growing sides of Hatay for the first time.

Materials and Methods

Plant materials: *Laurus nobilis* L. leaves and fruits were harvested in June and October 2004 respectively from Antakya, Yayladagi and Samandagi.

Isolation of the essential oils: Air-dried leaves were subjected to water distillation for 4 hr using a Clevenger-type apparatus to produce the essential oils. The same method was applied for the fruits. The oils were dried over anhydrous $CaCl_2$ and stored in sealed vials at low temperature before analysis. The essential oil yield was estimated according to dry leaves and fruit matter by using the following equation (Boutekedjiret *et al.,* 2003).

$$R_{HE}(\%)= (m_{HE}/m_S) \times 100$$

Where m_{HE} = essential oil mass (g), m_S = dry leaves and fruit matter mass (g), R_{HE} = essential oil yield(%).

Analysis and identification of components: The oils were analysed by GC-MS using Hewlett Packard GCD (model 6890) and Hewlett Packard MS (model 5972) equipped with a mass selective detector (MSD). An HP-5 column (30 m x 250 µm i.d.x film thickness 0.25 µm) and HP 18593B automatic injection system was used. 30 ml of essential oils was transferred into 1 ml of diethyl ether (Merck) and injected to the GC-MS sampling port. The chromatogram was produced by holding the oven temperature to 45°C for 5 min initially and then increasing the temperature to 130°C at a rate of 2°C/min followed by an increase at a rate of 3°C/min to 170°C and programmed to 220°C at a rate of 10°C/min then kept constant at 220°C for 5 min. MSD conditions were as follows: capillary direct interface temperature 250°C, ionisation energy 70 eV, mass range, 33-330 amu, EM voltage (Atune+200), scan rate 5 scan/s. Helium was used as the carrier gas at a flow rate of 1.5 ml/min. The components were identified by comparison of their mass spectra with Wiley GC-MS and NBS libraries. Relative percentage amounts of the separated compounds were calculated automatically from peak areas of the total ion chromatograms.

Results and Discussion

The chemical composition of the essential oil isolated from the fruits and leaves of *Laurus nobilis* L. collected from Antakya, Yayladagi and Samandagi which experience different climatic and geographic circumstances were determined by GC and GC/MS analysis. While collecting the experimental sample, we took care to pick up the leaves and fruits at the same developmental stage.

The qualitative and quantitative compositions of the essential oil of the leaves of *Laurus nobilis* L. are presented in Table I. As seen in the table, 25 different compounds were determined from the essential oil obtained from the leaves of *Laurus nobilis* L. which are grown in Antakya, Yayladagi and Samandagi. Although there was no marked difference in the composition of the leaves oil collected from Antakya, Yayladagi and Samandagi, Sabinene and α-Terpinenol compounds were determined to have a higher concentration in the leaves oil of Antakya comparing to Yayladagi and Samandagi. 1.8-cineole with a concentration of about 50% was found to be the major component in all the leaves essential oil collected from Antakya, Yayladagi and Samandagi (Table 1). The other major components of the essential oil are α-Terpinyl acetate and Sabinene in the leaves collected from Antakya, Yayladagi and Samandagi.

Table - 1: The essential oil composition of leaves of *Laurus nobilis* L. harvested from Antakya, Yayladagi and Samandagi (t = trace amount)

Components (in %)	Antakya	Yayladagi	Samandagi
α-Thujene	0.36	t	t
α-Pinene	3.66	2.19	2.61
Camphene	0.19	t	t
Sabinene	14.05	7.83	8.70
Myrcene	0.62	t	t
α-Phellandrene	t	t	t
1.8-Cineole	46.61	47.63	59.94
Trans-β-osimen	t	0.27	t
γ-Terpinene	0.37	0.75	0.79
Trans-Sabinene hydrate	1.28	0.48	0.52
Cis-Sabinene hydrate	0.58	0.37	t
α-Terpinolene	t	0.33	0.25
Linalool	0.64	0.40	0.37
Terpinen-4-ol	1.82	2.20	2.05
α-Terpinenol	6.83	1.43	1.94
α-Terpinyl acetate	11.94	25.70	16.33
Eugenol	t	0.65	t
β-Elemene	0.22	0.24	0.21
β-Caryophyllene	t	t	0.23
Methyl eugenol	1.95	3.39	0.41
α-Humulene	t	t	t
Caryophyllene oxide	1.26	0.30	0.92
Calamenene	0.52	0.30	0.28
β-Eudesmol	1.61	1.09	0.63
α-Eudesmol	1.04	0.34	0.10

Table - 2: The essential oil composition of fruits of *Laurus nobilis* L. harvested from Antakya, Yayladagi and Samandagi (t = trace amount)

Components (in %)	Antakya	Yayladagi	Samandagi
α-Thujene	t	0.38	0.35
α-Pinene	16.55	11.31	6.82
Camphene	2.08	0.80	0.81
β-Pinene	12.83	11.06	7.87
Myrcene	0.92	0.54	0.64
α-Phellandrene	15.87	10.58	13.28
para-Cymenene	0.55	t	t
Sabinene	6.03	4.55	5.65
1.8-Cineole	18.08	20.45	17.37
trans-β-osimen	11.88	19.89	28.35
Linalool	1.36	t	t
Bornil acetate	0.56	t	0.41
β-Elemene	3.06	4.46	2.68
α-Terpinyl acetate	4.10	4.88	3.67
β-Caryophyllene	t	1.52	0.67
Germacrene-D	0.90	1.69	0.87
Germacrene-A	2.81	4.35	3.17
α-Farnesene	0.59	1.82	1.68
Cis-α-Bisbolene	1.83	0.71	1.06

Previously, it was claimed that the qualitative and quantitative differences in essential oil composition was dependent more on the part of the plant and not on sampling season (Papachristos *et al.,* 2004). We also found that the composition of the essential oil obtained from *Laurus nobilis* L. leaves is different from the essential oil obtained from *Laurus nobilis* L. fruits in terms of qualitative and quantitative analysis (Table 1, 2). The essential oil extracted from *Laurus nobilis* L. leaves is characterized with a high content of 1.8-Cineole, Linalool and α-Terpinyl (Table 1), whereas fruits essential oil is characterized with high content of α-Pinene, α-Phellandrene, Sabinen, 1.8-Cineole and trans-β-osimen (Table 2). Bisio *et al*. (1999) claimed that ecological factors (climatic and soil conditios) have strong influence on the essential oil content, however, we found no significant variation in the composition of *Laurus nobilis* L. essential oils obtained from three distinct regions of Hatay. However, it was astonishing to find that trans-β-osimen is the major component of the essential oil obtained from Samandagi *Laurus nobilis* L. fruits (Table 2).

In this study, we also found that 1.8-cineole is one of the major components of fruits and leaves essential oil obtained from *Laurus nobilis* L. as explained previously by several researchers (Santos and Rao, 2000; Cimanga *et al*., 2002). Although there is not enough evidence about the biological role of this compound, several studies have suggested that cineoles, particularly 1.8-cineole, have inhibitory effect in germination or more generally in early plant development of plants (Vaughn and Spencer, 1993; Baum *et al*., 1998; Romagni *et al*., 2000). Recently, Moteki *et al*. (2002) reported that 1.8-cineole exerts antitumor activity on certain types of cancer cells by inducing apoptosis (Caliskan, 2000).

In conclusion our study has shown that the composition of the essential oil obtained from the *Laurus nobilis* L. leaves is different from the essential oil obtained from the *Laurus nobilis* L. fruits. We have also shown that the chemical composition of the essential oil obtained from the leaves and fruits of *Laurus nobilis* L. collected from three different regions of Hatay have different qualitative and quantitative properties.

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References

Bauer, K. and D. Garbe: Common fragrance and flavor materials, preparation, properties and uses. VCH. Weinheim, Germany (1985).

Baum, S.F., L. Karanastasis and T.L. Rost: Morphogenetic effect of the herbicide cinch on *Arabidopsis thaliana* root development. *J. Plant Growth Regul.,* **17**, 107-114 (1998).

Bisio, A., A. Corallo, P. Gastaldo, G. Romussi, G. Ciarallo, N. Fontana, N. De Tommasi and P. Profumo: Glandular hairs and secreted material in *Salvia blepharophylla* Brandegee ex Epling grown in Italy. *Annl. Bot. London,* **83**, 441-452 (1999).

Boutekedjiret, C., F. Bentahar, R. Belabbes and J.M. Bessiere: Extraction of rosemary essential oil by steam distillation and hydrodistillation. *Flavour. Frag. J.,* **18**, 481-484 (2003).

Caliskan, M.: Apoptosis, programmed cell death. *Tr. J. Zool.*, **24**, 31-35 (2000).

Cimanga, K., K. Kambu, L. Tona, S. Apers, T. De Bruyne, N. Hermans, J. Totte, L. Pieters and A.J. Vlietinck: Correlation between chemical composition and antibacterial activity of essential oils of some aromatic medicinal plants growing in the democratic republic of congo. *J. Ethnopharmacol.,* **79**, 213-220 (2002).

Dadalioglu, I. and A.G. Evrendilek: Chemical composition and antibacterial effects of essential oils of Turkish oregano (*Origanum minutiflorum*), bay laurel (*Laurus nobilis* L.), spanish lavender (*Lavandula stoechas* L.), and fennel (*Foeniculum vulgare*) on common foodborne pathogens. *J. Agric. Food Chem.,* **52**, 8255-8260 (2004).

Digrak, M., M.H. Alma and A. Ilcim: Antibacterial and antifungal activities of Turkish medicinal plants. *Pharm Biol.,* **39**, 346-350 (2001).

Fiorini, C., I. Fouraste, B. David and J. M. Bessiere: Composition of the flower, leaf and stem essential oils from *Laurus nobilis* L. *Flavour. Frag. J.,* **12**, 91-93 (1997).

Flamini, G., M. Tebano, P.L. Cioni, L.Ceccarini, A.S. Ricci and I. Longo: Comparison between the conventional method of extraction of essential oil of *Laurus nobilis* L. and a novel method which uses microwaves applied *in situ*, without resorting to an oven. *J. Chromatogr. A.*, **1143**, 36-40 (2007).

Hafizoglu, H. and M. Reunanen: Studies on the components of *Laurus nobilis* L. from Turkey with special references to laurel berry fat. *Lipid-Fett.,* **95**, 304-308 (1993).

Hogg, J.W., S.J. Terhune and B.M. Lawrenc: Dehydro-1.8-cineole: A new monoterpene oxide in *Laurus noblis* oil. *Phytochem.,* **13**, 868-869 (1974).

Kanat, M. and M.H. Alma: Insecticidal effects of essential oils from various plants against larvae of pine processionary moth (*Thaumetopoea pityocampa* Schiff) (Lepidoptera: Thaumetopoeidae). *Pest Manage. Sci.,* **60**, 173-177 (2004).

Kilic, A., H. Hafizoglu, H. Kollmannsberger and S. Nitz: Volatile constituents and key odorants in leaves, buds, flowers and fruits of *Laurus nobilis* L. *J. Agric. Food Chem.,* **52**, 1601-1606 (2004).

Knobloch, K., A. Pauli, N. Iberl, N. Weigand and H.M Weis: Antibacterial and antifungal properties of essential oil components. *J. Ess. Oil Res.,* **1**, 119-128 (1989).

Moteki, H., H. Hibasami, Y. Yamada, H. Katsuzaki, K. Imai and T. Komiya: Specific induction of apoptosis by 1.8-cineole in two human leukemia cell lines, but not a in human stomach cancer cell line. *Oncol. Rep.,* **9**, 757-760 (2002).

Muller-Riebau, F.J., B.M. Berger, O. Yegen and C. Cakir: Seasonal variations in the chemical compositions of essential oils of selected aromatic plants growing wild in Turkey. *J. Agric. Food Chem.,* **45**, 4821-4825 (1997).

Ozcan, M. and O. Erkmen: Antimicrobial activity of the essential oils of Turkish plant spices. *Eur. Food Res. Technol.,* **212**, 658-660 (2001).

Papachristos, D.P., K.I. Karamanoli, D.C. Stamopoulos and U. Menkissoglu-Spiroudi: The relationship between the chemical composition of three essential oils and their insecticidal activity against *Acanthoscelides obtectus* (Say). *Pest Manage. Sci.,* **60**, 514-520 (2004).

Rohloff, J., S. Dragland, R. Mordal and T.H. Iversen: Effect of harvest time and drying method on biomass production, essential oil, yield and quality of peppermint (*Mentha X piperita* L.). *J. Agric. Food Chem.,* **53**, 4143-4148 (2005).

Romagni, J.G., S.N. Allen and F.E. Dayan: Allelopathic effects of volatile cineoles on two weedy plant species. *J. Chem. Ecol.,* **26**, 303-313 (2000).

Santos, F.A. and V.S.N. Rao: Antiinflammatory and antinociceptive effects of 1.8-cineole a terpenoid oxide present in many plant essential oils. *Phytother. Res.,* **14**, 240-244 (2000).

Tilki, F.: Influence of pretreatment and desiccation on the germination of *Laurus nobilis* L.seeds. *J. Environ. Biol.*, **25**, 157-161 (2004).

Vaughn, S.F. and G.F. Spencer: Volatile monoterpenes as potential parent structures for new herbicides. *Weed Sci.,* **41**, 114-119 (1993).