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Research
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Regional Variation in the Essential Oil Composition of *Laurus nobilis* L.

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Abstract

Objective: The chemical profiles of essential oils derived from *Laurus nobilis* L. leaves collected across different ecological regions were comparatively analyzed.

Materials and Methods: Essential oils were obtained from *Laurus nobilis* L. leaves harvested from the central districts of Burdur, Mersin, and Sinop using a Clevenger apparatus, and their chemical composition was determined by GC–MS analysis.

Results: GC-MS analysis conducted within this study identified a total of 187–223 components, with findings reported for 37–40 constituents identified at a confidence level of 90% or higher. The total identified fractions for the Burdur, Mersin, and Sinop locations were 79.73%, 84.57%, and 86.08%, respectively. Results indicated that monoterpenes constituted the primary fraction (Burdur: 73.26%; Mersin: 62.88%; Sinop: 74.78%), with 1,8-cineole, α-terpinyl acetate, sabinene, terpinen-4-ol, and α-terpineol identified as the dominant compounds. While sesquiterpenes were categorized as minor fractions, diterpenes were represented solely by phytol at low concentrations. Furthermore, phenylpropanoids were found to be particularly abundant in the Mersin samples (15.36%).

Conclusion: The chemical profile of bay laurel essential oil demonstrated a dynamic metabolic pattern reflecting both the genetic characteristics of the species and the environmental conditions of its habitat. These findings emphasize the importance of considering geographical origin when evaluating the pharmacological, aromatic, and industrial potential of *Laurus nobilis* L., essential oil.

Keywords: *Laurus nobilis* L., essential oil composition, monoterpenes, geographic variation, Türkiye

Laurus nobilis L. Uçucu Yağ Kompozisyonunun Bölgesel Varyasyonu

Öz

Amaç: Farklı ekolojik bölgelerden toplanan *Laurus nobilis* L. yapraklarından elde edilen uçucu yağların kimyasal profilleri karşılaştırmalı olarak değerlendirilmiştir.

Materyal ve Metod: Burdur, Mersin ve Sinop merkez ilçelerinden hasat edilen *Laurus nobilis* L. yapraklarından Clevenger düzeneğiyle uçucu yağlar elde edilmiş, bu yağların kimyasal kompozisyonu ise GC–MS analiziyle belirlenmiştir.

Bulgular: Çalışma kapsamında gerçekleştirilen GC-MS analizleri sonucunda örneklerde toplam 187–223 bileşen saptanmış; %90 ve üzeri güvenilirlik düzeyiyle tanımlanabilen 37–40 bileşene dair bulgular raporlanmıştır. Bu bileşenlerin toplam oranları Burdur, Mersin ve Sinop lokasyonları için sırasıyla %79,73, %84,57 ve %86,08 olarak belirlenmiştir. Analiz sonuçları, uçucu yağların ana fraksiyonunu monoterpenlerin oluşturduğunu (Burdur: %73,26; Mersin: %62,88; Sinop: %74,78); baskın bileşenler arasında 1,8-sineol, α-terpinil asetat, sabinen, terpinen-4-ol ve α-terpineolün yer aldığını göstermiştir. Sesquiterpenler minör fraksiyonlar olarak tanımlanırken, diterpenler düşük konsantrasyondaki fitol ile temsil edilmiştir. Ayrıca, fenilpropanoidlerin özellikle Mersin örneklerinde (%15,36) yoğunlaştığı saptanmıştır.

Sonuç: Defne uçucu yağının kimyasal profili hem türün genetik yapısını hem de yetiştiği çevresel koşulları yansıtan dinamik bir metabolik özellik sergilemiştir. Bu durum, *Laurus nobilis* L. uçucu yağının farmakolojik, aromatik ve endüstriyel kullanım potansiyelinin değerlendirilmesinde coğrafi kaynak faktörünün dikkate alınmasının önemini vurgulamaktadır.

Anahtar Kelimeler: *Laurus nobilis* L., uçucu yağ kompozisyonu, monoterpenler, coğrafik varyasyon, Türkiye

Introduction

Bay laurel (*Laurus nobilis* L.) is an important spice plant widely used in Western and Asian cuisines due to its evergreen nature and characteristic aroma. This aromatic species, which can reach a height of 2–10 meters (Sırıken et al., 2018), belongs to the Lauraceae family, comprising approximately 32 genera and 2,000–2,500 species (Chahal et al., 2017). However, the natural distribution of the species is not limited to this region; it occurs widely throughout the Western Mediterranean Basin, including Türkiye, Algeria, Belgium, France, Greece, Mexico, Morocco, Portugal, Spain, the Canary Islands, Albania, Romania, the eastern coasts of Libya, western Syria, and Crimea (Karık, 2015).

Within the vegetation of Türkiye, *Laurus nobilis* L., also known as Mediterranean bay laurel, is naturally distributed (Karataş, 2024). This species accounts for approximately 90% of global bay leaf production (Yılmaz and Çiftçi, 2021). In Türkiye, it is particularly concentrated in the Aegean and Mediterranean regions and occurs naturally within vegetation zones ranging from sea level to 1,200 m elevation in the provinces of Balıkesir, Bursa, Yalova, İstanbul, Zonguldak, Kastamonu, Sinop, Trabzon, Rize, İzmir, Muğla, Antalya, Mersin, and Kahramanmaraş (Alhamad, 2022). In parallel with this wide distribution, Türkiye is one of the world's leading producer and supplier countries of bay leaves (Chahal et al., 2017; Yılmaz and Çiftçi, 2021). Other major producer countries at the global scale include Italy, Belgium, Algeria, France, Tunisia, Iran, Morocco, Serbia, Greece, Portugal, as well as countries in Central and South America (Singletary, 2021).

Laurus nobilis L. is a plant of considerable industrial importance and is utilized in the food, pharmaceutical and cosmetic industries (Patrakar et al., 2012; Ayanoğlu et al., 2018). Its dried leaves and essential oils are widely used in the food sector, particularly for flavoring meat products, soups, meat and fish dishes (Özcan and Chalchat, 2005). In addition to its use as a spice, the plant also attracts attention due to its pharmacological properties. Bay laurel has a long history of medicinal use in traditional medicine due to its various pharmacological activities, including antimicrobial, antifungal, antioxidant, anticancer, anti-inflammatory, cytotoxic, anti-asthmatic, anti-arthritic, and analgesic effects (Boulila et al., 2015; Bendjersi et al., 2016; Nabila et al., 2022; Zibi et al., 2022).

The industrial, pharmacological, and aromatic properties of medicinal and aromatic plants originate from the secondary metabolites they contain. These compounds, commonly referred to as essential oils, are also known as volatile, aromatic, ethereal, or fragrant oils (Başer and Demirci, 2007).

Secondary metabolites are organic compounds synthesized by plants that do not play a direct role in growth, development, or reproduction. These compounds not only confer economic value to the plant but also function as protective defense mechanisms against environmental stress factors, pests, and microorganisms (Tiring et al., 2021; Nurhaslina et al., 2022; Bhatla and Lal, 2023).

Studies investigating the essential oil composition of bay (*Laurus nobilis* L.) leaves obtained from different geographical regions have demonstrated that chemical content varies depending on the cultivation area (Caputo et al., 2017; Fidan et al., 2019). It has also been reported that essential oil components are influenced by ecological factors, harvest period, distillation parameters, and storage conditions (Sırıken et al., 2018).

Researchers have identified 1,8-cineole, α-terpinyl acetate, sabinene, α-phellandrene, eugenol, methyl eugenol, α-pinene, β-ocimene, and β-pinene as the principal constituents responsible for the characteristic aroma and pharmacological value of bay leaves (Caputo et al., 2017; Fidan et al., 2019; da Silveira et al., 2014; Boulila et al., 2015; Sırıken et al., 2018).

In this study, it was aimed to determine the composition of essential oil components, considered as quality parameters, in *Laurus nobilis* L. populations naturally distributed in the Burdur, Mersin, and Sinop locations within the flora of Türkiye.

Materials and Methods

In this study, bay leaf samples harvested during September–October 2023 were collected from the central districts of Burdur (36°53′–37°50′ N, 29°24′–30°53′ E), Mersin (36–37° N, 33–35° E), and Sinop (41–42° N, 34–35° E) provinces.

Leaf samples were collected from the upper, middle, and lower parts of each tree in accordance with the principle of homogeneous sampling and were stored in plastic bags to prevent moisture loss. After being transported to the Laboratory of the Department of Plant and Animal Production at Ordu University Technical Sciences Vocational School, the samples were dried in an oven at 35 °C for 48 hours.

Essential Oil Distillation

Drog leaf samples were homogenized using a blender prior to distillation. The distillation process was carried out at boiling temperature for 3 hours using a Clevenger-type apparatus. At the end of this period, the essential oil accumulated on the surface of the water was transferred into glass vials, labeled to preserve chemical integrity, and stored at 4 °C in a refrigerator until further analysis.

GC–MS Parameters

Qualitative and quantitative analyses of the essential oil components were performed at the Central Research Laboratory of Amasya University. The identification of compounds was conducted using the W9N11.L and MPW2011.L libraries. The instrument and operating parameters used in the analyses are presented in detail below.

GC-MS analyses were performed using an Agilent 7890A gas chromatography system integrated with a 5975C mass spectrometer (MS). Component separation was carried out on a DB-WAX capillary column (60 m × 0.25 mm i.d., 0.25 µm film thickness). Helium was used as the carrier gas at a constant flow rate of 1.2 mL/min, with an injection volume of 1 µL. The oven temperature program was optimized to start at 60 °C for 3 minutes, followed by an increase to 240 °C at a rate of 3 °C/min, and maintained at this temperature for 5 minutes.

A total of 187–223 components were identified as a result of the analyses conducted, and findings regarding the 37–40 components identified with a confidence level of 90% or higher were evaluated.

Results and Discussion

The essential oil composition of bay leaves collected from the central districts of Burdur, Mersin, and Sinop is presented in Table 1.

Examination of the table indicates that monoterpenes constituted the main component group in the essential oils of bay leaves collected from all locations, with proportions ranging between 62.88% and 74.78%. This result demonstrates that bay laurel essential oils are characteristically rich in monoterpenes. Previous studies conducted on bay samples grown in different geographical regions have similarly reported monoterpenes as the dominant component group; thus, our findings are consistent with the existing literature (Marzouki et al., 2009; Caputo et al., 2017).

It is well established that essential oil compositions obtained from a species under different ecological conditions reflect environmental factors such as altitude, duration of sunlight exposure, and soil characteristics (Figueiredo et al., 2008). In the present study, marked differences in the distribution of essential oil components were observed among locations. In samples obtained from the Burdur location, monoterpenes accounted for 73.26% of the essential oil, while diterpenes, sesquiterpenes, and phenylpropanoids were detected at 0.04%, 3.13%, and 3.30%, respectively, representing 79.73% of the total identified components. In the Mersin location, the monoterpene proportion decreased to 62.88%, while the diterpene content remained the same as in Burdur (0.04%). However, the proportions of sesquiterpenes (6.29%) and phenylpropanoids (15.36%) increased, and 84.57% of the essential oil composition was identified. In the Sinop samples, monoterpenes reached the highest level at 74.78%, within a total identified composition of 86.08%, whereas the diterpene proportion (0.02%) was lower compared to the other locations. The sesquiterpene (4.62%) and phenylpropanoid (6.66%) contents in Sinop displayed intermediate values between those of Burdur and Mersin.

When monoterpene compounds were examined, 1,8-cineole—known for its anti-inflammatory, antioxidant, antiviral, and antimicrobial effects and beneficial effects in respiratory conditions such as asthma (Juergens et al., 2020) —was identified as the major component in all locations. This finding indicates that the analyzed samples are consistent with the 1,8-cineole chemotype. The 1,8-cineole content was determined as 30.02% in Burdur samples, 20.36% in Mersin samples, and 32.87% in Sinop samples. The higher proportions of this compound in Burdur and Sinop compared to Mersin may suggest that monoterpene biosynthesis is associated with environmental stress factors occurring under cooler and more humid conditions (Figueiredo et al., 2008; Loreto and Schnitzler, 2010; Dudareva et al., 2013).

Among monoterpene esters, α-terpinyl acetate—widely used as a fragrance component in soaps, shampoos, antiperspirants, lotions, room sprays, cleaning and furniture-care products, and laundry and dishwashing detergents (Vaičiulytė et al., 2021)—was identified as the second major component in all samples. The proportion of this compound was 8.41% in Burdur, 14.82% in Mersin, and 12.77% in Sinop samples. These differences indicate a pronounced chemical variation among locations. This variation demonstrates that essential oil composition is sensitive to environmental conditions and that notable chemical differences may arise within the same species. Indeed, previous studies have reported that the biosynthesis of esterified monoterpenes such as α-terpinyl acetate is influenced by temperature, light intensity, and particularly by biotic and abiotic stress-related metabolic regulation (Figueiredo et al., 2008; Sangwan et al., 2001). Similarly, variations in α-terpinyl acetate content associated with location have been reported in bay and other aromatic plants grown under different ecological conditions, supporting the view that this compound is an environmentally responsive secondary metabolite (Sellami et al., 2011; Božović and Ragno, 2017).

Sabinene, a bicyclic monoterpene, is recognized as an important essential oil component that contributes to the characteristic aroma of spices (Menon and Padmakumari, 2005) and has been reported in the literature for its antifungal (Yamasaki et al., 2007) and anti-inflammatory (Valente et al., 2013) activities. In the present study, sabinene was identified as the third major component in all investigated locations. It was detected at rates of 5.25%, 5.96%, and 6.28% in samples from Burdur, Sinop, and Mersin, respectively. These findings are consistent with previous reports in the literature. Indeed, Muñoz-Bertomeu et al. (2007) and Perrino et al. (2021) have emphasized that secondary metabolite production in plants is not determined solely by genetic factors but is also shaped by environmental parameters such as altitude, temperature, light duration, and soil characteristics. In this context, the differences observed in sabinene content in our study may be associated with ecological variables.

Terpinen-4-ol, another important monoterpene, was identified as the fourth major component in the essential oil profile in this study. Quantitative differences were observed among locations, with the lowest value recorded in Mersin samples (2.31%), followed by Sinop (3.75%), and the highest proportion detected in Burdur (5.55%). This variation suggests that terpinen-4-ol biosynthesis may be sensitive to environmental and ecological factors. Das and Prakash (2023) reported that the biosynthesis and yield of essential oils are regulated by environmental parameters such as light, temperature, drought, salinity, heavy metals, seasonal variations, and mineral concentrations, and that these factors also influence the chemical structure and stability of essential oil components. Furthermore, the biological activity of terpinen-4-ol is well documented; Cox et al. (2000) and Carson et al. (2006) demonstrated that this compound exerts its effect by disrupting microbial cell membrane integrity. Additionally, Yadav and Rao (2016) highlighted its anti-inflammatory, antimicrobial, antifungal, antiviral, and potential anticancer properties, emphasizing its pharmacological significance. In this regard, its identification as the fourth major component in the present study may be considered noteworthy in terms of the biological potential of the essential oil.

α-Terpineol, one of the characteristic monoterpene alcohols of bay laurel essential oil, is a compound possessing various biological activities, including antioxidant, anti-inflammatory, antiproliferative, antimicrobial, and analgesic effects, in addition to its aromatic properties (Sales et al., 2020). In the present study, this component was detected at the highest level in the Burdur samples (5.02%), while slightly lower levels were observed in the Sinop samples (4.79%). In contrast, α-terpineol was not detected in the samples from the Mersin location. This finding suggests that ecological conditions may have suppressed certain biosynthetic pathways or redirected metabolic flux toward alternative monoterpenes. The variation in the presence and proportion of α-terpineol among locations indicates that the essential oil profile does not exhibit a fixed composition but rather reflects a dynamic metabolic structure sensitive to environmental conditions (Malik et al., 2023).

α- and β-Pinene are monoterpenes with versatile biological activities. In addition to their use as flavoring and fragrance agents, they are employed in various industrial and pharmaceutical applications due to their antiviral, antifungal, and antimicrobial properties. These compounds are also included as components in the formulations of certain medications used in the treatment of kidney and liver disorders. It has been reported that they exhibit antibacterial activity through toxic effects on cell membranes and demonstrate inhibitory effects against breast cancer and leukemia cells (Salehi et al., 2019). In the present study, both compounds were identified in the essential oils of bay samples obtained from all investigated locations. The lowest proportion of α-pinene was observed in the Mersin samples (2.44%), followed by Burdur (2.87%) and Sinop (3.14%). A similar distribution pattern was observed for β-pinene, with the lowest level again detected in the Mersin samples (2.27%), while higher contents were found in Sinop (2.57%) and Burdur (2.67%) samples. These findings indicate that although the presence of these monoterpenes is conserved across locations, their relative proportions vary depending on geographical factors.

Table 1 Composition of essential oil components from Burdur, Mersin and Sinop provinces (%)

		Burdur	**Mersin**	**Sinop**
No	**Monoterpenes (%)**	**73.26**	**62.88**	**74.78**
1	α-terpinene	0.68	0.17	0.47
2	α-terpinyl acetate	8.41	14.82	12.77
3	Terpinen-4-ol	5.55	2.31	3.75
4	Linalool	0.81	2.25	2.51
5	α-terpineol	5.02	nd	4.79
6	1,8-cineole	30.02	20.36	32.87
7	α-pinene	2.87	2.44	3.14
8	β-pinene	2.67	2.27	2.57
9	Camphene	0.15	0.16	0.19
10	Bornyl acetate	0.39	0.60	0.51
11	Phellandrene	0.37	0.92	0.05
12	Sabinene	5.25	6.28	5.96
13	α-terpinolene	0.32	0.14	0.24
14	β-myrcene	0.19	0.83	0.42
15	D-limonene	0.23	1.93	0.28
16	γ-terpinene	1.07	0.46	0.81
17	Δ- 3- carene	0.07	0.34	0.05
18	Pinocarvone	0.89	0.70	0.15
19	trans-sabinene hydrate	0.19	0.62	0.92
20	1-terpineol	0.92	1.18	1.00
21	Myrtenal	0.86	nd	0.16
22	Δ-terpineol	1.10	0.61	nd
23	Neryl acetate	nd	0.86	0.35
24	Dihydrocarveol	2.06	nd	nd
25	trans-(+)-carveol	0.47	nd	nd
26	p-cymen-7-ol	0.46	0.14	0.15
27	Cymol	2.01	2.38	0.67
28	p-cymen-8-ol	0.23	0.11	nd
	Diterpenes (%)	**0.04**	**0.04**	**0.02**
29	Phytol	0.04	0.04	0.02
	Sesquiterpenes (%)	**3.13**	**6.29**	**4.62**
30	Ylangene	0.24	0.07	0.19
31	β-elemene	nd	1.22	nd
32	Caryophyllene	0.23	0.40	0.96
33	Germacrene-D	0.13	0.33	0.28
34	Bicyclogermacrene	nd	0.79	0.18
35	Caryophyllene oxide	0.66	0.03	0.95
36	Spathulenol	0.41	1.56	0.72
37	β-selinene	0.44	0.74	0.82
38	Δ-cadinene	0.17	0.05	0.15
39	Bisabolene	nd	0.55	nd
40	γ-Cadinene	0.54	nd	nd
41	α- eudesmol	0.31	0.55	0.37
	Phenylpropanoids	**3.30**	**15.36**	**6.66**
42	Eugenol	1.24	5.61	2.35
43	Methyl eugenol	1.66	7.73	2.19
44	Elemicin	nd	1.69	nd
45	trans-cinnamyl acetate	0.40	0.33	2.12
	Total (%)	**79.73**	**84.57**	**86.08**

nd: not detected.

Cymol was detected at similar levels in samples obtained from the Burdur (2.01%) and Mersin (2.38%) locations. In contrast, its proportion was determined as 0.67% in the Sinop samples, suggesting that cymol biosynthesis may occur at a lower level in this region.

Some components within the monoterpene fraction were not detected in a location-specific manner. Accordingly, myretenal was not identified in the Mersin location; Δ-terpineol in Sinop; neryl acetate in Burdur; dihydrocarveol and trans-(+)-carveol in Mersin and Sinop; and p-cymen-8-ol in Sinop.

Consistent with these findings, the literature reports that the principal components of bay leaf essential oil are monoterpenes such as 1,8-cineole, α-terpinyl acetate, sabinene, terpinen-4-ol, α-terpineol, α/β-pinene, and cymol (Yalçın et al., 2007; Karık et al., 2015; Fidan et al., 2019; Paparella et al., 2022; Güneş et al., 2024; Jaradat et al., 2024). The identification of monoterpenes as the dominant fraction in all locations in the present study indicates that monoterpene biosynthesis in bay laurel is largely conserved despite environmental differences. However, the variations observed in monoterpene proportions among locations demonstrate that environmental factors influence essential oil composition. Karık et al. (2015) reported significant differences in bay essential oil composition depending on the sampling region. Similarly, Chahal et al. (2017) documented qualitative and quantitative variations in certain chemical constituents of bay essential oil according to collection sites.

The diterpene composition of bay laurel essential oil was represented solely by phytol in all samples, with proportions varying between 0.02% and 0.04%. The detection of only phytol within the diterpene fraction at such low levels indicates that diterpenes have a limited representation in the chemical profile of bay laurel essential oil. This finding is consistent with the general consensus in the literature that bay essential oil is primarily rich in monoterpenes and sesquiterpenes (Caputo et al., 2017; Sellami et al., 2011). Phytol is a naturally abundant compound and a valuable essential oil constituent used as a fragrance agent. It is considered a potential candidate for various applications in the pharmaceutical and biotechnology industries. Recent studies on phytol have reported its metabolism-regulating, antioxidant, anti-inflammatory, and antimicrobial effects (Olofsson et al., 2014; Islam et al., 2018; Islam et al., 2023).

As shown in Table 1, sesquiterpenes were detected at lower proportions compared to monoterpenes. The highest total sesquiterpene content was determined in the Mersin samples (6.29%), followed by Sinop (4.62%) and Burdur (3.13%). Within this group, spathulenol (0.41–1.56%), β-selinene (0.44–0.82%), caryophyllene (0.23–0.96%), and caryophyllene oxide (0.03–0.95%) were particularly prominent.

These results are consistent with reports indicating that monoterpenes (such as 1,8-cineole, sabinene, and α-terpinyl acetate) generally occur at high levels in the chemical profile of bay laurel essential oil, while sesquiterpenes, although present as minor constituents, may still contribute to the biological and aromatic properties of the oil (Caputo et al., 2017; Güneş et al., 2024). Sesquiterpenes such as caryophyllene and caryophyllene oxide, which are widely distributed in the plant kingdom, are known for their antioxidant, anti-inflammatory, antifungal, anticancer, and skin-regenerating properties. In addition to their pharmacological activities, they impart a distinctive aroma and contribute to the biological activity profile of essential oils used in the food, pharmaceutical, and cosmetic industries (Scandiffio et al., 2020). The presence of spathulenol, β-selinene, caryophyllene, and caryophyllene oxide identified in our study has also been reported in various bay laurel essential oil profiles in the literature, where these compounds were shown to contribute to the total sesquiterpene fraction (Caputo, 2017). Furthermore, findings indicate that sesquiterpene proportions in bay oils obtained from different geographical regions may vary due to local environmental conditions and genetic differences (Özcan and Chalchat, 2005).

When the total proportion of compounds belonging to the phenylpropanoid group was examined, the highest value was observed in the bay samples obtained from the Mersin location (15.36%), followed by Sinop (6.66%) and Burdur (3.30%). When evaluated individually, eugenol (5.61%) and methyleugenol (7.73%) were found at particularly high levels in the Mersin samples, whereas trans-cinnamyl acetate reached its highest proportion in the Sinop samples (2.12%). Elemicin was detected only in the Mersin samples at a rate of 1.69%.

These findings support recent studies indicating that geographical conditions are an important determinant of the chemical profile of bay laurel essential oil (Güneş et al., 2024).

Phenylpropanoids such as eugenol and methyleugenol have been reported to occur in variable amounts in bay essential oil, particularly in Mediterranean-origin samples, where their levels range from trace to moderate concentrations (Ordoudi et al., 2022). These compounds are described in the literature as phenolic derivatives that enrich the aroma and biological activity profile of the oil (Fantasma et al., 2024). Studies investigating the biological effects of phenylpropanoids have demonstrated that methyleugenol and eugenol possess strong antioxidant and radical-scavenging activities. Their radical-scavenging capacity may contribute to the protective effects of the essential oil (Nenadis et al., 2021; de Oliveira et al., 2024).

The trans-cinnamyl acetate identified in this study, although less frequently reported as an essential oil component, has been described in some samples as a synergistic aromatic ester (Marzouki et al., 2009). Such compounds belong to the group of aromatic esters that contribute to the odor profile of essential oils, and their variation may be associated with geographical differences. The detection of elemicin exclusively in the Mersin samples (1.69%) represents another indicator of the chemical diversity observed in this study. The presence of rare phenylpropanoids such as elemicin may be useful in defining sub-chemotypes of the essential oil and has been associated in the literature with population-specific chemical signatures (Medina et al., 2008).

Conclusion

In this study, the chemical composition of essential oils obtained from *Laurus nobilis* L. leaves was comparatively examined in samples collected from the Burdur, Mersin, and Sinop locations. The total proportion of identified components ranged between 79.73% and 86.08%, representing the majority of the essential oil composition.

The findings demonstrated that monoterpenes constituted the main fraction of the essential oil in all locations (62.88–74.78%), confirming that bay laurel essential oil is characteristically rich in monoterpenes.

However, the variation in total monoterpene content among locations—particularly in the relative proportions of key constituents such as 1,8-cineole, α-terpinyl acetate, sabinene, terpinen-4-ol, and α-terpineol—indicates that the essential oil composition does not exhibit a fixed profile.

The fact that the diterpene fraction was represented solely by phytol at very low levels (0.02–0.04%) suggests that this group of compounds plays a limited role in bay laurel essential oil. In contrast, sesquiterpenes such as caryophyllene, caryophyllene oxide, spathulenol and others, although present as minor fractions (3.13–6.29%), may exert complementary effects on the biological and aromatic profile of the oil.

The significantly higher proportion of phenylpropanoids in the Mersin samples (15.36%) and the absence of α-terpineol in certain locations indicate that environmental conditions may influence secondary metabolite biosynthesis.

Overall, the results suggest that while the fundamental chemical profile of bay laurel essential oil is preserved across locations, the relative distribution of components varies according to ecological and environmental factors. Therefore, geographical origin should be considered when evaluating the pharmacological, aromatic, and industrial potential of bay laurel essential oil.

Author Contributions

All authors contributed equally to the manuscript.

Disclosure Statement

There is no conflict of interest among the authors.

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