J. Fac. Pharm. Ankara / Ankara Ecz. Fak. Derg., 50(2): 362-370, 2026
Doi: 10.33483/jfpau.1605981
Research Article / Araştırma Makalesi

VOLATILE COMPONENTS OF *DAPHNE* SP. NATURALLY GROWN IN TÜRKİYE

TÜRKİYE'DE DOĞAL OLARAK YETİŞEN DAPHNE TÜRLERİNİN UÇUCU BİLEŞİMLERİ

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ABSTRACT

Objective: *The Daphne genus, belongs to the Thymelaeacea, which includes approximately 500 plant species and 44 taxa. In this study, the volatile components of 7 species (Daphne mezereum L., D. pontica L., D. glomerata Lam., D. sericea Wahl., D. oleoides Schreber, D. gnidioides Jaub et. Spach and D. mucronata Royle) and 2 subspecies (D. mucronata subsp. turcica and D. oleoides subsp. kurdica) of the genus Daphne naturally grown in Türkiye were investigated.*
Material and Method: *The volatile profiles of the hydrodistillated samples were analysed by gas chromatography-flame ionization detector (GC-FID) and gas chromatography-mass spectrometry (GC/MS), simultaneously.*
Result and Discussion: *The major volatile components for all samples were determined as tricosane (16.0-0.3%), pentacosane (17.6-1.2%), phytol (11.4-0.6%), heptacosane (10.1-1.0%) and hexadecanoic acid (53.2-9.0%).*
Keywords: *Daphne* L.*, GC-FID, GC/MS, volatile component*

ÖZ

Amaç: *Daphne cinsi, yaklaşık 500 bitki türü ve 44 taksonu içeren Thymelaeacea famiyasına aittir. Bu çalışmada, Türkiye'de doğal olarak yetişen Daphne L. cinsine ait 7 türden (D. mezereum L., D. pontica L., D. glomerata Lam., D. sericea Wahl., D. oleoides Schreber, D. gnidioides Jaub. et Spach ve D. mucronata Royle) ve 2 alt türden (D. mucronata subsp. turcica ve D. oleoides subsp. kurdica) elde edilen uçucu bileşikler araştırılmıştır.*
Gereç ve Yöntem: *Hidrodistilasyonla elde edilen uçucu bileşiklerin kimyasal profilleri, gaz kromatografisi-alev iyonizasyon dedektörü (GK-AID) ve gaz kromatografisi/kütle spektrometrisi (GK/KS) ile eş zamanlı olarak analiz edilmiştir.*
Sonuç ve Tartışma: *Tüm örneklerde ana bileşikler trikosan (%16.0-0.3), pentakosan (%17.6-1.2), fitol (%11.4-0.6), heptakosan (%10.1-1.0) ve hekzadekanoik asit (%53.2-9.0) olarak belirlenmiştir.*
Anahtar Kelimeler: *Daphne* L.*, GK-AID, GK/KS, uçucu bileşik*

INTRODUCTION

Plants have an important role in protecting human health and improving the quality of life. Since ancient times, they have attracted much attention due to their beneficial effects. The demand for treatment with herbs has increased especially because of the side effects seen in synthetic drugs.

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Submitted date: 23.12.2024 **Accepted date:** 07.04.2026 **Published date:** 19.05.2026
Citation: Ozturk, G., Demirci, B. (2026). Volatile components of *Daphne* sp. naturally grown in Turkiye. Journal of Faculty of Pharmacy of Ankara University, 50(2), 362-370.

In addition, they are used in other areas of life as feed, landscaping, components of cosmetic products and dyes [1-3].

In recent years, there are many little-known and unknown plants that need to be scientifically evaluated through chemical analysis, pharmacological, therapeutic, toxicological studies and clinical trials. Research of these plants is of great importance in terms of new bioactive molecules [4].

One of these genera, the *Daphne* genus, belongs to the Thymelaeacea, which includes approximately 500 plant species and 44 taxa. Plant species belonging to the genus *Daphne* are used in traditional medicine in the treatment of various diseases in tropical regions of China and Africa. There are seven *Daphne* sp. commonly known in Türkiye (*D. mezereum* L., *D. pontica* L., *D. glomerata* Lam., *D. sericea* Wahl., *D. oleoides* Schreber, *D. gnidioides* Jaub. et Spach, *D. mucronata* Royle) [5]. In addition to these, *D. caucasia* Pall., *D. cneorum* L. *D. gnidium* L. and *D. laureola* L. species also grow, but the distribution of these species in Türkiye needs to be determined [6].

D. mezereum L. is a perennial, upright shrubby plant. It is 50-150 cm tall. Young shoots are hairy; old branches are bare, glabrous, bark is light gray. Leaves with petioles up to 12 mm long, herbaceous, oblanceolate, 30-90 x 9-20 mm in size, obtuse or broadly acute, glabrous; abaxial surface is slightly blue-green. Flowers are lateral, in the axils of fallen leaves, 3-6, sessile, fragrant. Bracts are ovate, 6 mm, caducous Perianth 8-12 mm, dark or pale pink, compressed short, softly hairy; lobes are ovate, 3-5 mm, broadly acute or obtuse. Ovary is glabrous. Fruit is nearly spherical; red. Flowering time is between March and June. Its habitat is mountain slopes, under oak-pine forests, at an altitude of 1600-2130 m [5].

D. pontica L. leaves are 8 cm long, entire, petiolate and obovate, shiny, dark green; small, fragrant, four-lobed flowers are found at the ends of branches, yellow-green in color. It is a small shrub that can grow up to 1 meter tall, has a trunk width of 1.5 meters, and its flowers are usually followed by black fruits [7]. It usually flowers between March and August. It grows on volcanic rocks, on limestone slopes, in Abies-Fagus forests. It is found between sea level and 2200 m. It is widely distributed in the Black Sea region [5].

D. glomerata Lam. is a small deciduous shrub (about 50 cm) [6]. The leaf surface is glabrous and leathery. The flowers are bisexual, 4-merous, calyx tubular, fragrant, in the axils of the apical leaves, at the ends of the shoots, in groups of 3 to 15 in a false capitulum inflorescence. The corolla is about 15 mm long, pink on the outside and white inside, glabrous. The pistil is small, 3 mm long. The ovary is superior, glabrous, sessile, style absent or capitate. The fruit is a bright red drupe [8]. The gray bark of the plant is thick. Flowering occurs in May-July. The plant grows in the alpine and subalpine mountain zone, from sea level to 1800-2500 m [5].

D. sericea Wahl. is a semi-woody, short shrub, evergreen species [6,9]. Morphologically, this species is characterized by erect or decumbent branches and leathery leaves, oblong-obovate, almost glabrous on the upper surface of the curved branches and with protruding hairs below. The flowers are large, hermaphrodite and entomophilous. Very fragrant, pink, mostly collected in terminal heads, blooming between February and May [5,10,11].The fruit is a reddish-brown drupe [11]. It grows on limestone, in serpentine and schizont, sparse *Pinus brutia* forests, at an altitude of 0-1500 m [5].

D. oleoides Schreber is a much-branched shrub, 15-60 cm tall. Young shoots reddish-brown, densely short soft or silky hairy, older branches glabrous, bark grayish. Leaves sessile or 1-2 mm long, leathery, obovate, oblanceolate or elliptic, broadly acute, obtuse or mucronate, dull bluish-green with thickened margins; young leaves densely or sparsely white hairy, upper surface usually glabrous. Flowers sessile, fragrant, in terminal clusters of 3-6. Bracts absent or small, triangular-ovate, 2x1 mm, acute, caducous. Perianth 10-16 mm, white or creamy white, imprinted-hairy; lobes acute. Ovary hairy. Fruit oval, 4-6 mm, orange-red. *D. oleoides* grows on limestone, slopes and rocks, *Quercus* scrub, *Pinus nigra* forests, *Astragalus-Acantholimon* steppes, streams and roadsides, at altitudes of 1050-3200 m. Flowering time is between May and August [5].

D. oleoides subsp. *kurdica* grows on volcanic rocks, limestone crevices, highland pastures and roadsides, at altitudes of 760-3000 m. Flowering time is between June and September [5].

D. gnidioides Jaub & Spach is an erect shrub, 0.5-2 m tall. Branches with brown or grey hairs on

leafy parts. Leaves almost sessile, leathery, narrowly elliptic or oblanceolate, mucronate, glabrous. Flowers in terminal clusters of 3-12, pedicels up to 6 mm long. Bracts 2-3, lanceolate, glabrous, caducous. Perianth almost persistent, mustard yellow or slightly pink, hairy; lobes oblong, 3 mm, apex obtuse. Ovary hairy. Fruit ovoid, 5-7 mm, orange-red. It grows naturally on limestone cliffs, schist, sandstone cliffs and volcanic soils. It is found at altitudes of 1150 m above sea level. In Türkiye, it is distributed in the Aegean-Mediterranean regions. It blooms between May and August [5].

D. mucronata Royle is an erect shrub, 0.5-3 m tall. Branches reddish-brown, glabrous (very rarely hairy) in leafy parts. Leaves sessile or short-petiolate, narrowly elliptic, acuminate or mucronate, glabrous. Flowers fragrant, 8-14 in short terminal panicles; pedicels up to 5 mm long. Bracts absent. Perianth almost persistent, 9-14 mm, yellow-silky hairy; lobes ovate, obtuse or broadly acute. Ovary hairy. Fruit 7-9 mm, orange-red. It is widespread on rocky slopes, limestone and dry open fields at altitudes of 1100-2880 m. It is found in the South-Eastern Anatolia region of Türkiye. It blooms between July and September [5].

Many phytochemical studies have shown the presence of various chemical classes in the essential oil and extracts of *Daphne*. The major classes were terpenoids, flavonoids, coumarins, fatty acids and alkanes [3,12-16]. The majority of the chemical composition of *Daphne* sp. consists of coumarin compounds. Daphnetin, daphnetin-8-*β*-glucoside, daphnin, umbelliferone and acetyl-umbelliferone were determined as the main compounds [3,12]. Apigenin, daphnolidin A, kaempferol, luteolin, and rhamnetin are the main flavonoids found in *Daphne* genus [13,14]. Carvone, spathulenol, carvacrol [15,16], linalool, linalool oxide, myrcene [17] were reported as major volatile components of genus *Daphne* [3,18].

In traditional medicine of Türkiye, *D. mezereum* has been used as a purgative and emetic among the public. Traditionally, the leaves soaked in alcohol or mixed with honey have been used as a dressing for wounds and ulcers. The fruit has been used as a purgative. The bark has been used externally as an irritant and against abscesses [19]. A decoction prepared from *D. mucronata* has been applied to the hair and used to treat headaches [20]. *D. pontica* roots have been used to against diarrhea [21]. *D. oleoides* has been used traditionally for rheumatism, skin diseases, gonorrhea, fever or related inflammatory diseases, infections and malaria [22,23].

This genus has a wide range of biological activities, including antimicrobial, antioxidant, analgesic, anti-inflammatory, cytotoxic, antiulcerogenic, abortive, hypocholesterolemic, hemostatic and antidiabetic effects [3,18,24-27]. *Daphne* species have diuretic, sudorific and laxative effects. The resin it carries has irritating properties. Therefore, they should be used with caution and under control. They are considered poisonous plants.

In this study, it was aimed to determine the volatile components of 7 species and 2 subspecies of *Daphne* grown in Türkiye naturally. *D. oleoides* were collected from different localities and volatile compositions were compared.

MATERIAL AND METHOD

Plant Materials

The *Daphne* sp. (Figure 1) was collected from different localities in Türkiye and aerial parts of plants air-dried. The voucher specimens have been deposited in the herbarium of the Faculty of Pharmacy, Anadolu University in Eskisehir. Volatile components were obtained by Clevenger apparatus by 3 h. The informations about the *Daphne* sp. were listed in Table1.

Analysis of Volatile Components

The volatile components were analyzed by GC-FID and GC/MS, simultaneously [28].

Table 1. The informations about the genus *Daphne* sp.

Plant	Code	Herbarium No	Date	Location
D. gnidioides	D1	ESSE15556	24.11.2018	C2, Muğla
D. glomerata	D2	ESSE 15557	08.07.2019	A8, Trabzon
D. mucronata	D3	ESSE 15558	01.08.2019	C9, Şırnak
D. mucronata* subsp. *turcica	D4	ESSE 15559	01.08.2019	C10, Hakkâri
D. pontica	D5	ESSE 15560	08.07.2019	A8, Trabzon
D. oleoides* subsp. *kurdica	D6	ESSE 15561	01.08.2019	B9, Bitlis
D. oleoides	D7	ESSE 15562	05.08.2019	B7, Erzincan
***D. oleoides* (Bilecik)**	D8	ESSE 15563	19.07.2019	A2, Bilecik
D. sericea	D9	ESSE 15869	21.07.2020	A2, Bilecik
D. mezereum	D10	ESSE 15870	05.06.2022	A8, Artvin



Figure 1. General views of *Daphne* sp. a: *Daphne mucronata* Royle; b: *Daphne mucronata* subsp. *turcica* Royle; c: *Daphne oleoides* Schreber; d: *Daphne oleoides* Schreber (Bilecik); e: *Daphne oleoides* subsp. *kurdica* Schreber; f: *Daphne pontica* L.; g: *Daphne glomerata* Lam.; h: *Daphne mezereum* L.; i: *Daphne sericea* Vahl.; j*: Daphne gnidioides* Jaub. & Spach *Photo by: M. Fırat, G.Öztürk, M. Çelik, S. Güner, M. Çiçek*

RESULT AND DISCUSSION

Volatile components of *Daphne* species were obtained by hydrodistillation. Due to the lack of yields volatile components collected by *n*-hexane. The common volatile components for all samples were determined as tricosane (16.0-0.3%), pentacosane (17.6-1.2%), phytol (11.4-0.6%), heptacosane (10.1-1.0%) and hexadecanoic acid (53.2-9.0%) (Figure 2). Other components were listed in Table 2.

Table 2. Volatile components of *Daphne* sp.

[a]RRI	COMPONENT	D1 [b]%	D2 %	D3 %	D4 %	D5 %	D6 %	D7 %	D8 %	D9 %	D10 %
1200	Dodecane	-	-	-	-	-	-	-	-	0.1	-
1244	2-Penthylfuran	-	-	0.1	-	-	-	-	-	0.2	-
1274	1,3,5-Trimethyl benzene	1.2	-	-	-	-	-	-	-	-	-
1374	4-Hydroxy-4-methyl-2-pentanone	1.4	-	-	-	-	-	-	-	-	-
1400	Nonanal	-	-	0.1	-	-	-	-	-	0.6	-
1496	2-Ethyl hexanol	1.3	-		-	-	-	-	-	-	-
1506	Decanal	-	-	-	-	-	-	-	-	1.5	-
1600	*β*-Elemene	-	-	-	-	-	-	-	-	-	0.2
1600	Hexadecane	-	-	-	-	-	-	-	-	0.2	-
1612	*β*-Caryophyllene	5.6	-	0.1	2.0	-	-	-	-	-	-
1617	Undecanal	-	-	-	-	-	-	-	-	0.3	-
1655	(*E*)-2-Decenal	-	-	-	-	-	-	-	-	0.3	0.8
1667	*β*-Barbatene	-	-	-	-	-	-	-	-	0.7	-
1700	Heptadecane	-	-	-	-	0.3	-	0.5	-	-	0.5
1705	Zizanene	-	-	-	-	-	-	-	-	-	0.7
1722	Dodecanal	-	-	-	-	-	-	-	-	0.4	-
1742	*β*-Selinene	-	-	0.1	-	-	-	-	-	-	-
1764	(*E*)-2-Undecenal	-	-	-	-	-	-	-	-	-	0.3
1800	Octadecane	1.5	-	0.2	0.6	0.4	0.9	1.0	5.2	[c]tr	0.5
1830	Tridecanal	-	-	-	0.2	-	-	2.0	0.2	-	-
1838	(*E*)-*β*-Damascenone	-	-	-	-	-	-	-	-	0.3	-
1868	(*E*)-Geranyl acetone	1.2	-	0.1	-	0.1	-	-	-	0.6	3.2
1900	Nonadecane	-	0.8	0.4	-	-	-	-	-	0.2	1.1
1900	*Epi*-cubebol	-	-	-	1.6	-	-	-	-	-	-
1933	Tetradecanal	-	-	-	1.2	-	0.3	0.4	-	1.5	-
1941	α-Calacorene	-	-	-	-	-	-	-	-	-	0.4
1958	(*E*)-*β*-Ionone	-	-	0.2	-	0.2	0.1	0.7	1.0	0.5	1.1
1973	1-Dodecanol	-	-	-	-	0.1	-	0.5	0.5	-	0.3
2000	Eicosane	-	-	-	0.9	-	-	-	-	-	0.7
2008	Caryophyllene oxide	6.8	-	-	1.3	-	-	-	-	-	-
2041	Pentadecanal	-	-	-	-	-	-	0.5	-	-	-
2050	*(E)*-Nerolidol	-	-	-	0.2	-	0.6	0.7	2.1	-	1.0
2100	Heneicosane	-	0.9	0.9	-	1.5	-	-	-	0.2	2.3
2131	Hexahydrofarnesyl acetone	-	-	1.1	0.3	0.2	4.3	3.0	3.4	1.5	1.0
2173	6-*epi*-Cubenol	-	-	-	-	-	-	-	-	-	0.4
2179	3,4-Dimethyl-5-pentiliden-2(5H)-furanone	-	-	-	-	-	-	-	-	0.2	-
2179	1-Tetradecanol	-	-	0.2	-	tr	-	-	-	-	tr
2192	Nonanoic acid	-	-	-	0.1	-	tr	tr	2.0	0.2	-
2200	Docosane	-	tr	-	-	1.5	0.9	1.1	2.3	-	1.0
2226	Methyl hexadecanoate	-	0.4	-	-	tr	-	-	-	-	tr

Table 2 (*continue*). Volatile components of *Daphne* sp.

[a]RRI	COMPONENT	D1 [b]%	D2 %	D3 %	D4 %	D5 %	D6 %	D7 %	D8 %	D9 %	D10 %
2241	Heptadecanal	-	-	-	-	-	1.0	1.1	1.0	-	-
2256	Hexadecanal	-	-	-	0.3	-	0.2	2.1	-	-	-
2256	Cadalene	-	-	-	-	-	-	-	-	-	tr
2260	Ethyl hexadecanoate	-	-	1.1	1.1	0.1	-	-	-	-	-
2271	Eicosanal	-	-	0.1	-	-	-	-	-	-	1.7
2298	Decanoic acid	-	-	-	-	-	-	-	-	0.2	-
2300	**Tricosane**	**8.8**	**4.5**	**5.8**	**3.8**	**4.3**	**14.6**	**10.7**	**16.0**	**0.3**	**4.1**
2324	Caryophylladienol II	4.7	-	-	-	-	-	-	-	-	-
2384	1-Hexadecanol	-	-	-	-	0.5	-	-	-	0.3	0.6
2384	Farnesyl acetone	-	0.1	1.2	0.8	-	-	-	-	0.4	1.3
2389	Caryophyllenol I	1.4	-	-	-	-	-	-	-	-	-
2392	Caryophyllenol II	2.7	-	-	-	-	-	-	-	-	-
2400	Tetracosane	2.3	0.7	1.0	-	0.7	2.3	1.4	2.5	-	1.6
2400	Undecanoic acid	-	-	-	-	-	-	-	-	0.1	-
2500	**Pentacosane**	**11.7**	**3.0**	**4.3**	**4.8**	**3.1**	**15.9**	**9.8**	**17.6**	**1.2**	**1.8**
2503	Dodecanoic acid	-	-	-	-	-	0.6	1.0	0.8	0.4	-
2613	Ethyl linolenate	-	0.3	0.7	-	-	-	-	-	-	-
2600	Hexacosane	1.5	0.2	-	-	-	-	-	-	-	-
2607	1-Octadecanol	-	-	0.4	-	0.6	-	-	-	-	2.5
2617	Tridecanoic acid	-	2.0	-	-	-	-	-	-	0.3	-
2622	**Phytol**	**1.6**	**0.1**	**11.4**	**8.3**	**2.3**	**5.3**	**3.5**	**4.6**	**0.6**	**1.3**
2655	Benzyl benzoate	-	-	-	-	-	-	1.0	-	-	-
2670	Tetradecanoic acid	-	0.2	5.3	0.5	5.1	4.3	4.6	2.5	7.8	4.4
2700	**Heptacosane**	**10.1**	**1.0**	**1.8**	**4.9**	**5.8**	**7.0**	**7.5**	**8.2**	**6.9**	**0.9**
2795	1-Eicosanol	-	-	0.8	-	0.7	-	-	-	-	2.3
2800	Octacosane	-	-	-	-	-	-	-	-	1.8	-
2822	Pentadecanoic acid	-	-	0.8	-	0.5	-	-	-	tr	2.0
2900	Nonacosane	10.0	4.7	3.5	12.4	3.2	-	-	-	7.4	3.8
2931	**Hexadecanoic acid**	**9.0**	**53.1**	**39.9**	**29.1**	**42.5**	**31.5**	**39.8**	**17.8**	**53.2**	**34.5**
2933	Nonacosene	-	-	0.6	-	1.3	-	-	-	-	2.3
3151	Stearic acid	-	-	-	-	-	-	-	-	0.6	-
3200	Oleic acid	-	tr	-	0.7	-	-	-	-	0.9	-
3290	Linoleic acid	-	12.8	-	9.5	-	-	-	-	1.6	-
3300	Linolenic acid	-	11.1	-	10.1	-	-	-	-	1.1	-
	TOTAL	**82.8**	**95.9**	**82.2**	**94.7**	**75.0**	**89.8**	**92.9**	**87.7**	**94.6**	**80.6**

[a]RRI: Relative retention indices calculated against *n*-alkanes; [b]%: calculated from FID data; [c]tr: %<0.1; -: not detected; D1: *D. gnidioides* volatile components; D2: *D. glomerata* volatile components; D3: *D. mucronata* volatile components; D4: *D. mucronata* subsp. *turcica* volatile components; D5: *D. pontica* volatile components; D6: *D. oleoides* subsp. *kurdica* volatile components; D7: *D. oleoides* volatile components; D8: *D. oleoides* (Bilecik) volatile components; D9: *D. sericea* volatile components; D10: *D. mezereum* volatile components

As a result of the analyzes, volatile compounds were determined as common for all species. When the volatile components of *D. oleoides* collected from different locations were examined, no significant differences were observed.

When the literature is reviewed, in a study from *Daphne* species, hexahydrofarnesyl acetone (8.6%), carvacrol (8.5%), dihydroedulan II (4.7%), (*E*)-geranyl acetone (4.6%) and thymol (4.5%) was determined as the main compound for *D. pontica* essential oil [29]. In the same study, the essential oil obtained from *D. oleoides* nonacosane (42.5%), hexadecanoic acid (24.4%), phytol (12.3%) and carvacrol (5.0%) were determined as the main compound [29]. In addition, microdistillation studies were carried out with *D. pontica* and *D. oleoides* and volatile compounds were obtained. After this procedure, carvacrol (12.0%), thymol (7.7%), dihydroactinidiolide (7.2%), bicyclosesquifellandrene

(5.5%) and (*Z*)-3-hexenal (4.1%) were determined as the main components for *D. pontica*, carvacrol (27.2%), nonacosane (24.6%), (Z)-3-hexanal (18.5%), decane (7.4%), hexahydrofarnesyl acetone (7.4%), hexanal (6.6%), heptacosan (6.1%), nonanal (5.6%), thymol (5.1%) and phytol (5.0%) were determined as the main components for *D. oleoides* [29]. Another study with the same species identified seventy-nine compounds representing 95.2% of the total oil. Nootkatone (18.5%), nootkatin (12.1%) and daphnauranol C (11.7%) were determined as the main components in the essential oil [30]. Ashraf et al., (2018) conducted with essential oils obtained from the leaves and roots of *D. mucronata* pentadecane (12.7%), 2-methyl hexadecane (8.9%), 7,9-dimethyl hexadecane (8.9%), tetradecane (7.3%), 5-propyl decane (6.1%), 2,3,5,8-tetramethyl hexadecane (5.8%), 2-methyl-6-propyl dodecane (5.1%) and 5-methyl tetradecane (5.1%) were found as the main compounds of the leaves af essential oil. In the essential oil obtained from its roots, 11,14,17-eicosatrienoic acid methyl ester (18.5%), methyl palmitate (16.0%), (*Z,Z*)-9,12-octadecadienoic acid methyl ester (13.9%), tetratriacontane (6.6%) and caryophyllene oxide (5.9%) were identified as the main compounds [31]. Bahadırlı and Türkmen (2020) reported that, pentacosane (13.9%), methyl linoleate (10.9%), tetratetracontene (9.7%), decanal (8.0%), pentatriacontane (6.8%), ethyl linoleate (3.9%), methyl palmitate (3.6%), tridecanal (3.4%), nonal (3.1%), germacrene-D (3.0%), and *cis*-farnesol (3.0%) were found as major compounds of *D. sericea* essential oil [10]. In other study, hexanoic acid (32.0%), phytol (20.9%) and octadecane (13.8%) were found as major components of *D. mucronata* essential oil [32].

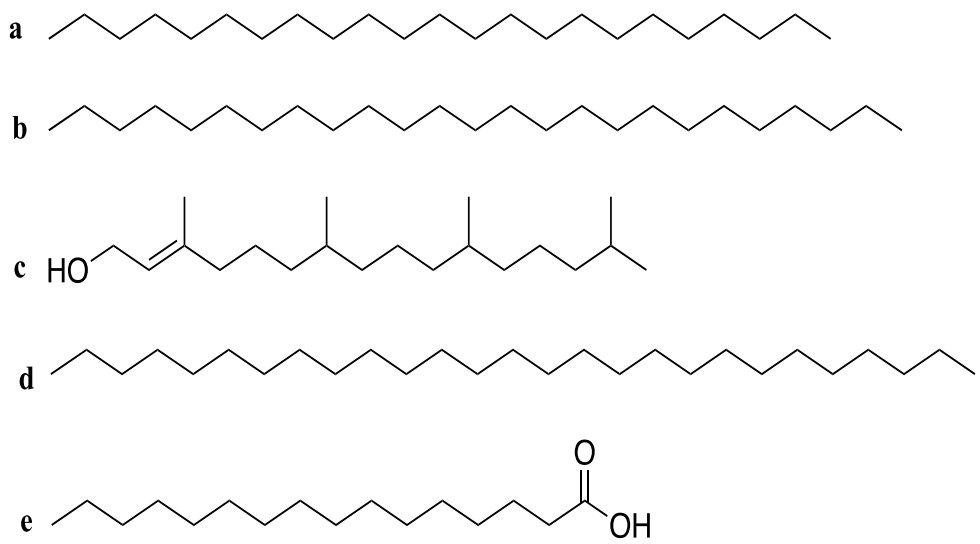

Figure 2. Major volatile components of *Daphne* sp. a: tricosane; b: pentacosane; c: phytol; d: heptacosane; e: hexadecanoic acid

In future studies, it is planned to collect more plants and conduct various biological activity studies with the essential oils obtained. This study is a preliminary study that will provide information about volatile compounds.

ACKNOWLEDGEMENTS

The plants were identified by Prof. Dr. Yavuz Bülent KÖSE, Prof. Dr. Atila OCAK, Prof. Dr. Mehmet ÇİÇEK, Prof. Dr. Sinan GÜNER and Res. Ass. Dr. Mehmet FIRAT. This work was presented at the 15th SCNC- International Symposium on the Chemistry of Natural Compounds, Antalya, Türkiye. This work was supported as a PhD thesis (No: 786674) and financially supported by Anadolu University Scientific Research Projects (BAP 1808S280).

AUTHOR CONTRIBUTIONS

Concept: G.Ö., B.D.; Design: B.D.; Control: B.D.; Sources: G.Ö.; Materials: G.Ö.; Data Collection and/or Processing: G.Ö.; Analysis and/or Interpretation: G.Ö.; B.D.; Literature Review: G.Ö.; Manuscript Writing: G.Ö.; Critical Review: B.D.; Other: -

CONFLICT OF INTEREST

The authors declare that there is no real, potential, or perceived conflict of interest for this article.

ETHICS COMMITTEE APPROVAL

The authors declare that the ethics committee approval is not required for this study.

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