AkiNik

American Journal of Essential Oils and Natural Products

Available online at www.essencejournal.com

AJEONP American Journal of Essential Oils and Natural Products

ISSN: 2321-9114
AJEONP 2020; 8(1): 06-09

Received: 03-11-2019
Accepted: 04-12-2019

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Essential oil compositions of *Daphne sericea* vahl. flowers with hydrodistillation method

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Abstract
The genus *Daphne* from Thymelaeceae family, mostly consists of trees, shrubs, subshrubs, and herbaceous plants. The *Daphne* genus has seven species in the flora of Turkey. The genus has two species in the flora of Hatay: *Daphne sericea* Vahl. and *Daphne oleiodes* var. *kurdica* Schreber. *D. sericeae* has been studied for some properties but no scientific report has been found for essential oil composition. The aim of this study is to reveal the essential oil content and components of *Daphne sericea* Vahl. flowers from the flora of Hatay. Essential oil content of *Daphne* was found very low. GC-MS analysis showed 49 component represented 99.71% of essential oil. Most of the essential oil components were found as pentacosane (13.94%), methyl linoleate (10.92%), tetratetracontene (9.74%), decanal (8.08%), pentatriacontane (6.85%), ethyl linoleate (3.95%), methyl palmitate (3.60%), tridecanal (3.41%), nonal (3.17%), germacrene-D (3.06%), cis-farnesol (3.05%). pentacosane (13.94%), methyl linoleate (10.92%), tetratetracontene (9.74%), decanal (8.08%), pentatriacontane (6.85%), ethyl linoleate (3.95%), methyl palmitate (3.60%), tridecanal (3.41%), nonal (3.17%), germacrene-D (3.06%), cis-farnesol (3.05%).

Keywords: Daphne sericea, *essential oil, GC-MS, Hatay*

1. Introduction
Essential oils have a great interest due to their usage in pharmaceutical, sanitary, cosmetic, agricultural and food industries. Discovery of new sources of essential oils has become objective of many studies [1]. Thymelaeaceae family contains 50 genera and more than 800 species around the world. Flora of Turkey has 3 genera of the family, which are *Daphne*, *Diarthron* and *Thymelaea*. Total of 19 species naturally occur in the flora from those 3 genera. The genus *Daphne* is represented by seven species in Turkey's flora (*D. glomerata* Lam., *D. gnidioides* Jaub. & Spach, *D. mezereum* L., *D. mucronata* Royle, *D. oleoides* Schreber, *D. pontica* L. and *D. sericea* Vahl.) [2]. *Daphne* species have a usage especially for cancer and rheumatism treatments in modern and folk medicine [3, 4, 5]. *Daphne sericea* Vahl. is an evergreen species, which is also semi-woody, low shrub, distributed in the central and eastern part of the Mediterranean basin (Italy, Greece, Turkey, and Lebanon). *Daphne sericea* Vahl. flowers are large, hermaphrodite and entomophil [6]. The plants have importance as ornamental plants particularly *D. sericea* because of its beautiful pink-violet fragrant flowers. *D. sericea* and *D. oleiodes* var. *oleiodes* naturally occur in the flora of Hatay. The flowering period starts in February and lasts till the beginning of May. Many studies have been done to reveal phytochemical properities of *Daphne* species and showed that the genus contains many secondary metobolites such as coumarins, flavonoids, and terpenoids [7, 8, 9]. Volatile molecules and color of flower plays an essential role to attract pollinator animals. *Daphne sericea* flower odor found higher after sunset that believed increase moth activity which encourage pollination [10]. Essential oil composition and antioxidant capacity of *Daphne oleiodes* subsp. *oleoides*, *D. pontica* L. from Turkey were presented in some studies [9, 11, 12, 13]. In other studies, *D. gnidium* L. and *D. genkwa* Sieb. et Zucc. species essential oil compositions were revealed [14, 15]. The aim of this study was to introduce essential oil contents and components of *Daphne sericea* flowers. To the best of our knowledge, there is no report in the literature addressing the profile of *Daphne sericea* essential oils.

2. Materials and methods
2.1. Plant Material
Plant materials of Daphne sericea were collected from the rural areas of Hatay province in Turkey, in March, at noon.

Herbarium specimen (Voucher no: KN177) was deposited at the Herbarium Collection of Field Crops Department. Flowers and leaves were separated and fresh flowers were directly usedfor essential oil analysis. Voucher specimen was identified in Hatay Mustafa Kemal University department of Biology.

2.2. Essential Oil Extraction

Flowers were hydrodistilled for 3 h using Clevenger type apparatus according to the method recommended in the British Pharmacopoeia. Samples were replicated 3 times. Essential oil content was very low due to this essential oils were trapped in cyclohexane and directly analysed.

2.3. GC-MS analysis of the essential oils

The GC-MS (Gass Chromatography-Mass Spectrometer) analysis were carried out with Thermo Scientific ISQ Single Quadrupole model device. A TG-Wax MS model column (5% Phenyl Polysilphenylene-siloxane, 0.25 mm inside diameter × 30 m in length, having 0.25 µm film thickness) was used with the carrier gas helium. The MS transfer line temperature was set to 250 °C, MS ionization temperature was set to 220 °C. The column temperature starts at 50 °C and has risen up to 220 °C with 3 °C/min temperature rise rate. The split ratio was set to 10:1. Mass spectra were recorded at 70 eV, the mass range was from 1.2-1200 m/z. Scan Mode has been used in data collection. Structure of each compound has been defined by the Xcalibur program by using mass spectra.

3. Results & Discussion

Since a low amount (<0.01%) of essential oil, oils were obtained with cyclohexane. Essential oil component results from GC-MS analysis were given in Table 1 and chromatogram of it were given in Figure 1. In essential oil, 49 components were found which represents 99.71% of the essential oil. Main components were found as pentacosane (13.94%), methyl linoleate (10.92%), tetratetracontene (9.74%), decanal (8.08%), pentatriacontane (6.85%), ethyl linoleate (3.95%), methyl palmitate (3.60%), tridecanal (3.41%), nonal (3.17%), germacrene-D (3.06%), cis-farnesol (3.05%). Main components of *Daphne* essential oil have some pharmacological and chemical properties. Decanal from the *Daphne* essential oil could control blue mold rot on apple and pear fruits furthermore could suppress the expression of genes involved in patulin biosynthesis [16]. Patulin is a secondary product sysnthesis by molds such as Penicillium, Aspergillus and Byssochlamys and could cause a toxicity on fruit based (especially apple) products [17]. That could mean it probably protects the flowers from fungal infection and the nectar from fermentation. Pentacosane described as strong odor found in different plant species, such as *Oryza sativa* and *Scutelleria laeteviolacea* [18, 19]. Some studies revealed other *Daphne* species essential oil content and components. Main components of *D. pontica* essential oil from aerial part were determined as hexahydrofarnesyl-acetone (8.6%), carvacrol (8.5%), dihydroedulane II (4.7%), *(E)*-geranyl acetone (4.6%) and thymol (4.5%) [12]. In the same study, researchers found *D. oleiodes* var. *oleiodes* essential oil main components such as nonacosane (42.5-27.2%), hexadecanoic acid (24.4-20%), phytol (12.3%) and carvacrol (5%) [12]. Essential oil composition of *D. genkwa* flowers found as furfural (2.8%), α-copaene (3.1%), α-santalene (6.9%), β-caryophyllene (3.4%), β-santalene (2.4%), δ-cadinene (4.0%), methyl eugenol (4.6%), nerolidol (2.0%), elemicin (4.5%), and 2, 3-dihydrobenzofuran (2.7%) [14]. Essential oil compositions of *D. gnidium* aerial parts have been studied and major components were found mostly as carvone with 16.51% [15].

Table 1: Essential oil composition of *Daphne sericea* Vahl

RT	Compound Name	Ret Indice	Area %
13.22	Nonanal	1372	3.17
16.49	α-Copaene	1459	0.32
17.09	Decanal	1475	8.08
18.41	2-Nonenal (E)-	1509	0.40
19.07	Linalool	1527	1.33
20.2	α-Guaiene	1556	0.45
20.32	*cis*-Caryophyllene	1559	0.57
21.02	Undecanal	1578	2.32
23.34	β-Farnesene (E)-	1640	1.00
23.79	Lavandulol	1652	0.39
24.43	Germacrene D	1669	3.06
24.89	Dodecanal	1681	0.52
26.26	cis-Farnesol (E)-	1719	3.05
26.69	Geranyl propionate	1731	0.62
28.38	2,4-Decadienal (E,E)-	1778	0.65
28.64	Tridecanal	1785	3.41
30.88	β-Cedrene	1849	0.39
32.7	Linalyl acetate	1902	1.24
33.53	Phenylethyl isobutyrate	1927	0.71
33.76	2-Phenylethyl 3-methylbutanoate	1934	0.95
34.93	Eicosane	1969	0.35
36.17	*trans*-Caryophyllene	2005	0.50
38.11	Heneicosane	2049	0.84
39.03	Hexadecanal	2070	0.65
39.99	2-Phenylethyl butanoate	2092	2.61
41.16	Tricosane	2128	0.41
41.58	Methyl palmitate	2143	3.60
41.73	δ-Cadinol	2148	0.62
42.46	Farnesol	2173	1.59

44.09	Tetracosane	2226	1.06
45.28	Tetradecanal	2262	0.36
46.14	Phenethyl dodecanoate	2288	0.38
46.94	Pentacosane	2311	13.94
47.51	Methyl stearate	2328	0.40
48.03	Methyl oleate	2343	0.42
48.22	Oxirane. heptadecyl-	2348	0.32
48.42	Docosane. 9-butyl-	2354	1.35
49.14	Geranyl phenylacetate	2375	0.59
49.31	Methyl linoleate	2380	10.92
49.66	Tetratetracontane	2390	9.74
50.61	Nerolidol	2416	1.35
50.84	Hexadecanoic acid	2422	0.48
51.1	Ethyl linoleate	2428	3.95
52.34	Nonacosane	2461	0.34
52.6	Benzyl benzoate	2468	1.14
54.83	Pentatriacontane	2532	6.85
55.73	1-Nonadecanol	2560	0.58
56.41	Octadecanal	2581	1.74
Total			99.71

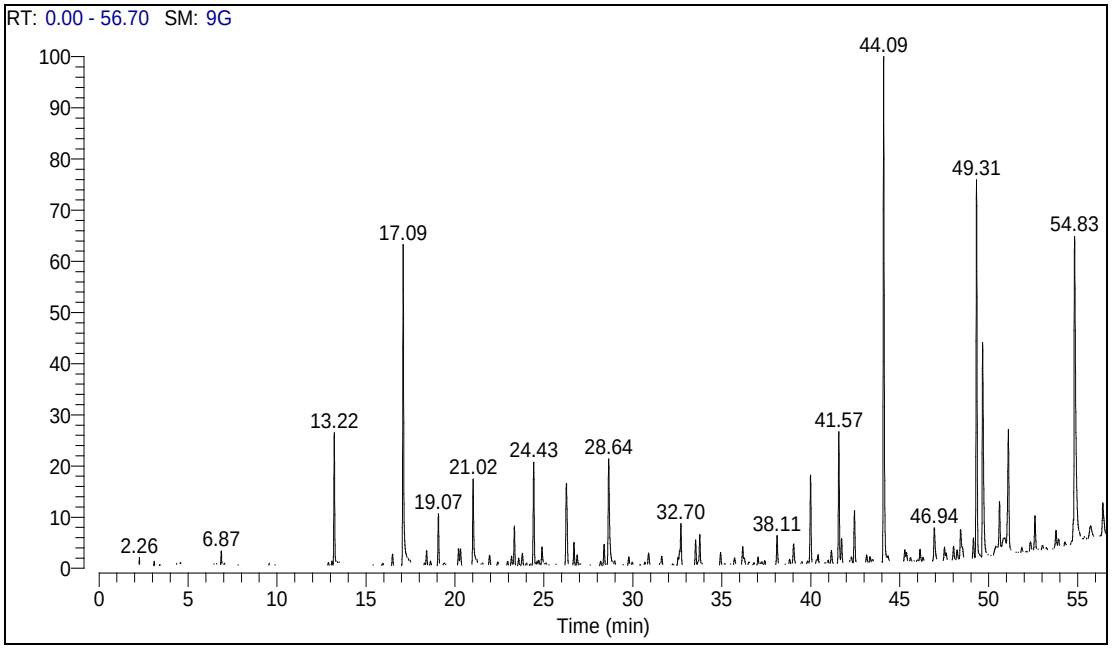

Fig 1: Chromatogram of *D. sericea* Vahl. essential oil

4. Conclusions

In the present study, the essential oil content of *D. sericea* flowers found very low amount, however, more studies should be done to present its biological, pharmacological, and toxicological properties Furthermore, agricultural applications could improve the essential oil content of the *D. sericea*.

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