DETERMINATION OF ESSENTIAL OIL COMPONENTS OBTAINED FROM LEAVES AND AERIAL PARTS OF *Ferulago syriaca*

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In this study, the contents of essential oils obtained from the leaves and aerial parts of *Ferulago syriaca* were investigated by GC-MS. *Ferulago syriaca* used in the study was obtained from Hatay flora. 57 components of the essential oils obtained from the leaves of the plant were determined at a rate of 99.99%. When the essential oil components obtained from the aerial-parts were examined, 43 components were determined at a rate of 98.47%. When the essential oil components obtained from *Ferulago syriaca* leaves and aerial parts were examined, the main components were determined as Myrcene, durylaldehyde, α-pinene, β-phellandrene, α-terpinolene, limonene, bornyl acetate, p-cymene in both parts of the plant.

Keywords: essential oil, GC-MS, *Ferulago syriaca*

INTRODUCTION

Ferulago syriaca, whose native range is Southern Turkiye, Syria, Israel and Cyprus, is an aromatic medicinal plant with anti-Alzheimer (Karakaya *et al*., 2018) and aphrodisiac (Öztürk *et al*., 2018) pharmacological activities proven in vitro. The essential oil content of the fruits and roots of the species was investigated (Erdurak *et al*., 2006). The essential oil yield of the fruits was 4.8%, the essential oil content was determined to be 27.8% monoterpene and 10.7% sesquiterpene. The main fruit essential oil compounds were found as myrcene (15.3), terpinolene (12.5) and 4,6-guaiadiene (10.7). The essential oil yield of the roots was found to be 1.1%, and it was determined that it consisted of oxygenated monoterpene (69.4) and monoterpene (12.5) compounds. Major compounds were found as bornyl acetate (69.4), and terpinolene (12.5). The essential oil content of aerial parts (i.e. leaves, branchs and flowers) has not been investigated, this is the first study on aerial part essential oils. In the study, the leaves and other aerial parts (branches and flowers) were studied and compared separately because the plant spends the first few years of its perennial life period above the ground just giving leaves (Figure 1, left). In this process, photosynthesizing leaves enlarge the root by sending storage nutrients to the root, which is in the form of rhizomes. After a development period of several years, the flowering branches of the plant occur (Figure 1, right). By the time it reaches the fruiting stage, the leaves are already dry. Since different stages of the plant's life cycle are represented by different organs, we found it worth examining the essential oil contents of the leaves separately from other aerial parts.

MATERIAL AND METHODS

Plant Material

The study material plant was collected from its natural habitat, Amanos Mountains-Hatay-Turkiye and identified by Yelda Güzel. A plant that has just formed its branches

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and flowers and whose leaves have not yet dried was preferred. Since the plant is 1.5 m tall and large, one plant was sufficient for the study. The essential oil yield of branches and flowers was 1.3%, and the essential oil yield of leaves was 2.9%. A voucher from the plant, numbered Y. Güzel-3135, was stored in the herbarium of the MKU biology department.

Figure 1. *Ferulago syriaca*, with only leaves above ground, during the first years of its life cycle (left), a few years old that has formed stems and flowers from above-ground parts (right)

Essential Oil Isolation

The essential oil was obtained from dried leaves. A total of 50 g of the ground plant samples was used for hydrodistillation experiment. A sample weight was individually and carefully placed into a 2000 ml flask. Distilled water was added until it covered the sample completely. Essential oils were obtained by hydrodistillation method which was carried out in an all-glass Clevenger-type distillation. The essential oil ratio was calculated according to dry weight of plant materials and amount of essential oils obtained. The obtained essential oil samples were dried over anhydrous sodium sulfate and stored in amber vials at +4 .

GC-MS Analysis of the Essential Oils

Analysis of the essential oil was carried out using a Thermo Scientific Focus gas chromatograph equipped with MS, auto sampler, and TR-5MS (5% phenyl polysilphenylene-siloxane, 0.25 mm i.d. x 60 m length, film thickness 0.25 µm). The carrier gas was helium (99.9%) at a flow rate of 1 mL/min; ionization energy 70 eV. Mass range m/z 50–650 amu. Data acquired at scan mode. MS transfer line temperature 250°C; MS ionization source temperature 220°C, injection port temperature 220°C. The samples were injected with a 250 split ratio. The injection volume was 1 µL. Oven temperature was programmed from 50°C to 220°C at 3°C /min. The structure of each

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compound was identified by comparison of their mass spectrum with the Wiley Registry, 9th edition.

RESULTS AND DISCUSSION

When the essential oil components obtained from the leaves and aerial parts of the *Ferulago syriaca* plant were examined, 57 components of the essential oils obtained from the leaves of the plant were determined at a rate of 99.99%. When the essential oil components obtained from the aerial-parts were examined, 43 components were determined at a rate of 98.47%. When the essential oil components obtained from *Ferulago syriaca* leaves and aerial parts were examined, the main components were determined as myrcene, durylaldehyde, α-pinene, β-phellandrene, α-terpinolene, limonene, bornyl acetate, p-cymene in both parts of the plant. The main component in the leaves was myrcene with a rate of 50.27%, followed by durylaldehyde, p-cymene and β-phellandrene components, respectively. Durylaldehyde ratio was determined as 6.55%, while p-cymene and β-phellandrene ratios were determined as 5.32% and 5.13%, respectively. When the essential oil components obtained from the aerial-parts of the plant were examined, the main component was myrcene with a rate of 51.32%. When the other components of the essential oil obtained from the aerial-parts are examined, it is seen that the durylaldehyde ratio is 6.75%. It is seen that this is followed by β-phellandrene with 5.01%, α-terpinolene with 4.6% and bornyl acetate with 4.16%. In previous study, the essential oil content was determined to be 27.8% monoterpene and 10.7% sesquiterpene. The main fruit essential oil compounds were found as myrcene (15.3), terpinolene (12.5) and 4,6-guaiadiene (10.7). The essential oil composition of the roots was found to be 1.1%, and it was determined that it consisted of oxygenated monoterpene (69.4) and monoterpene (12.5) compounds. Major compounds were found as bornyl acetate (69.4), and terpinolene (12.5) (Erdurak *et al*., 2006).

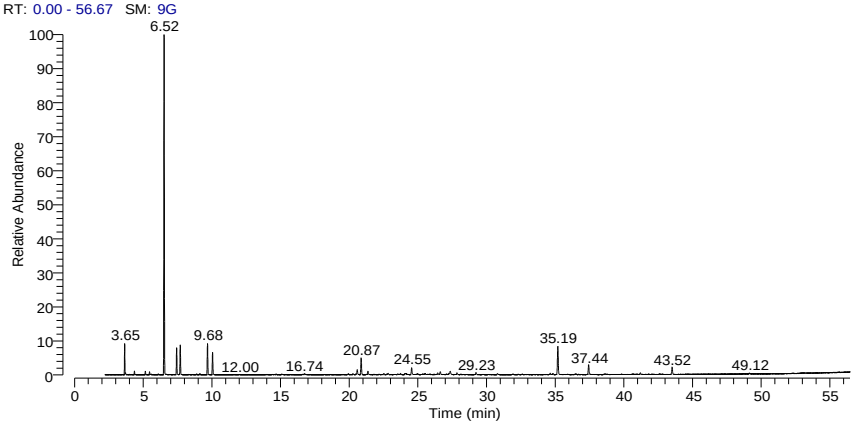

Figure 2. Essential oil chromatograms obtained from *Ferulago syriaca* leaf

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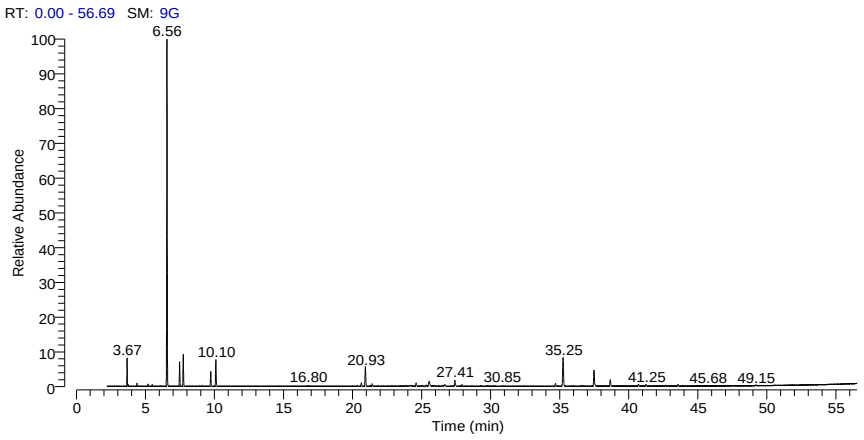

Figure 3. Essential oil chromatograms obtained from *Ferulago syriaca* aerial parts

Table 1. Essential oil components obtained from *Ferulago syriaca* leaf and aerial parts

		Area (%)	
RT	Compound Name	Leaves	Aerial parts
3.65	α-pinene	3.65	3.35
4.36	Camphene	0.49	0.44
5.16	β-pinene	0.48	0.30
6.1	3-carene	0.13	0.13
6.52	Myrcene	50.27	51.32
7.43	Limonene	4.14	3.73
7.7	β-phellandrene	5.13	5.01
8.86	γ-terpinene	0.11	0.12
9.1	α-ocimene	0.18	0.21
9.68	p-cymene	5.32	2.90
10.05	α-terpinolene	3.89	4.6
14.66	β-ocimene epoxide	0.11	nd
19.91	Linalool	0.18	nd
20.27	Cis-sabinene hydrate	0.23	nd
20.48	Safranal	0.12	nd
20.59	Chrysanthenyl acetate	1.01	0.73
20.87	Bornyl acetate	3.57	4.16
21.37	trans-caryophyllene	0.88	0.53
22.5	p-diethylbenzene	0.20	0.13
22.73	1-terpinenol	0.14	0.24

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RT	Compound Name	Area (%) Leaves	Aerial parts
22.84	β-farnesene epoxide	0.31	0.11
23.51	Pinocarvyl acetate	0.12	0.14
23.74	Verbenol	0.27	nd
24.05	Humulene	0.29	0.19
24.13	5-Ethyltricyclo[4.3.1.1(2,5)]undec-3-en-10-one	0.16	nd
24.55	cis-verbenol	1.47	0.92
24.89	α-muurolene	nd	0.1
24.98	1,8-menthadien-4-ol	0.29	0.21
25.35	Bornyl methyl ether	0.09	0.25
25.51	Germacrene D	0.28	0.21
25.55	Isoledene	nd	1.46
25.87	σ-cadinene	0.09	0.09
25.9	γ-gurjunene	nd	0.23
26.44	α-phellandren-8-ol	0.37	0.17
26.64	m-cymene	0.6	0.18
27.07	Piperitol isomer II	0.11	nd
27.26	1,5,7-Octatrien-3-ol, 2,6-dimethyl	0.24	nd
27.36	γ-muurolene	0.81	1.34
27.85	δ-elemene	0.55	0.5
28.11	Phenyl-2-nitropropene	0.11	nd
29.23	α-phellandrene	0.49	0.22
29.7	Perilla alcohol	0.08	0.19
30.8	p-Cymen-8-ol	0.28	0.19
32.58	Sabinyl acetate	0.11	nd
34.7	Cedrol	nd	0.71
34.82	Caryophyllene oxide	0.24	0.11
35.19	Durylaldehyde	6.55	6.75
36.45	10,13-octadecadiynoic acid, methyl ester	0.19	nd
37.44	Cubenol	2.24	3.86
38.61	β-eudesmol	0.17	1.42
41.2	Globulol	0.74	0.42
42.58	Carvacrol	0.17	nd
43.52	Spathulenol	1.62	0.42

Nd: not detected

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CONCLUSIONS

The contents of essential oils obtained from the leaf and aerial parts of *Ferulago syriaca* obtained from Hatay flora were examined by GC-MS and 57 components were determined in the essential oil obtained from the leaves of the plant and 43 components from the above-ground parts. As a result of the studies, the main components of the essential oils obtained from the leaves and aerial parts of *Ferulago syriaca* were determined as Myrcene, durylaldehyde, α-pinene, β-phellandrene, α-terpinolene, limonene, bornyl acetate, p-cymene, both in the leaves and in the aerial parts.

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