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Research Article
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Chemical Composition of the Essential Oil of *Heracleum platytaenium* BOISS. (Apiaceae) Growing Wild in Turkey

Türkiye'de Doğal Olarak Yetişen Heracleum platytaenium BOISS. (Apiaceae)'nin Uçucu Yağının Kimyasal Bileşimi

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Abstract

In this study, the essential oils of *Heracleum platytaenium* (Apiaceae) species in Sinop region of northern Turkey were investigated and 27 components were identified by GC, GC-MS. Essential oils were obtained by Clevenger-type hydrodistilled from the aerial parts of plants collected from the natural habitats. The essential oils yield is very low and 0.5 (v/w). Twenty seven constituents were comprised the 98.1% of the total essential oil extracted from the *Heracleum platytaenium*. The predominant compounds of *Heracleum platytaenium* were as Limonene (30.8%), Terpinolene (17.9%), β-Pinene (16.3%) and Ocimene (12.6%). The results were discussed in view of chemotaxonomy and natural products.

Keywords: Apiaceae, GC-MS, Essential oil, *Heracleum platytaenium*

Öz

Bu çalışmada, Türkiye'nin kuzeyinde bulunan Sinop bölgesindeki *Heracleum platytaenium* (Apiaceae) türlerinin uçucu yağları incelenmiş ve 27 bileşen GC, GC-MS ile tanımlanmıştır. Uçucu yağlar, doğal yaşam alanlarından toplanan bitkilerin toprak üstü kısımlarının Clevenger cihazında su distilasyonu yöntemiyle elde edildi. Uçucu yağların verimleri çok düşük ve 0,5 (v/w)'dir. Yirmi yedi bileşen, *Heracleum platytaenium*'dan ekstrakte edilen toplam uçucu yağın %98.1' ni oluşturmaktadır. *Heracleum platytaenium*'un baskın bileşikleri, Limonene (%30.8), Terpinolene (%17.9), β-Pinene (%16.3) and Ocimene (%12.6)' dir. Sonuçlar, kemotaksonomi ve doğal ürünler açısından tartışılmıştır.

Anahtar Kelimeler: Apiaceae, GC-MS, Uçucu yağ, *Heracleum platytaenium*

1. Introduction

Heracleum spp. plants belonging to family Apiaceae, have about 125 species. Fourteen species of them is represented in Turkey of which seven are endemic (Bayan et al. 2016, Kocak and Ozdemir, 2012). *Heracleum platytaenium* Boiss's is spread in the Black Sea, the Central Anatolia and the Aegean coasts. In general, it has occupied mixed forests, rocky slopes, stream sides and coasts. It has spread at the areas with height between 0 and 1500 m (Anonymous, 2016). *H. platytaenium* was a previously endemic plant, but was later removed from Turkey's endemic list (Güner et al. 2012). In Turkey, this plant is known as "Tavsancilotu" and is used against dysentery and diarrhoea (Baytop 1984).

It is strongly aromatic, perennial herbaceous and monocarpic species. The plant is a tall (1-2 m) with a thick stem and rootstock. The basal leaves are ternate, trisect or only pinnately lobed, lamina more than 25 cm long, glabrous to scabrid above, grey-tomentose below, the leaflets or primary divisions shortly lobed, the lobes broadly ovate or rounded, crenate-dentate. Upper cauline leaves with very broad, inflated, truncate to retuse, dentate sheaths. Rays 25-80, unequal, 3-18 cm, scabrid to hirsute. Bracteols linear lanceolate. Flowers are white. The fruits are dorsally compressed. The fruit shape is cordate and cordate to obovate, 8-14 x 6-11 mm. The mericarp apex is emarginate (Davis 1972, Genç 2014).

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The chemical composition of the essential oils were reported of *H. platytaenium*, *H. crenatifolium*, *H. sphondylium* subsp. *ternatum* obtained by different isolation techniques from Turkey (*Özek* et al. 2005, Akcin et al. 2013) and also essentials oils were reported of *Heracleum* species from other countries (Matejic et al. 2016, Radjabian et al. 2014, Firuzi et al. 2010, Evergetis et al. 2009, Sefidkon 2002; Tkachenko 1993).

The aim of the study, to determine the chemical essential oil profile of *Heracleum platytaenium*, intraspesific means and to contribute the systematics of the species. However, the results were discussed with the genus patterns of *Heracleum* in means of chemotaxonomy.

2. Material and Methods

2.1. Plant Materials

Heracleum platytaenium specimens were collected by Dr. Elkıran in June 2016 from İnaltı village in Ayancık (Sinop). The plant was identified by Dr. Elkıran and Hasan Yaşayacak (forest engineer). They were studied Sinop University, Scientific and Technological Research Application and Research Center, Sinop and Çankırı Karatekin University, Faculty of Science, Department of Chemistry, Çankırı, Turkey.

2.2. Isolation of the Essential Oils

Air-dried aerial parts of the plant materials (100 g) were subjected to hydrodistillation using a Clevenger-type apparatus for 3 h to extract the essential oil.

2.3. Gas Chromatography (GC) Analysis

The essential oil was analyzed using HP 6890 GC equipped with a FID detector and an HP-5 MS column (30m×0.25mm i.d., film thickness 0.25 mm) and the capillary column were used. The column and analysis conditions were the same as in GC-MS. The percentage composition of the essential oils was computed from GC–FID peak areas without correction factors.

2.4 Gas Chromatography/Mass Spectrometry (GC-MS) Analysis

The oil samples were analyzed by GC-MS, using a Hewlett Packard system. HP-Agilent 5973N GC-MS system with 6890 GC is in Çankırı Karatekin University, Faculty of Science, Department of Chemistry. HP-5 MS column (30m×0.25mmi. d., film thickness 0.25 mm) was used with helium as the carrier gas. Injector temperature was 250 ^{0}C, split flow was 1ml/min. The GC oven temperature was kept at 70 ^{0}C for 2 min and programmed to 150 ^{0}C at a rate of 10 ^{0}C / min and then kept constant at 150 ^{0}C for 15

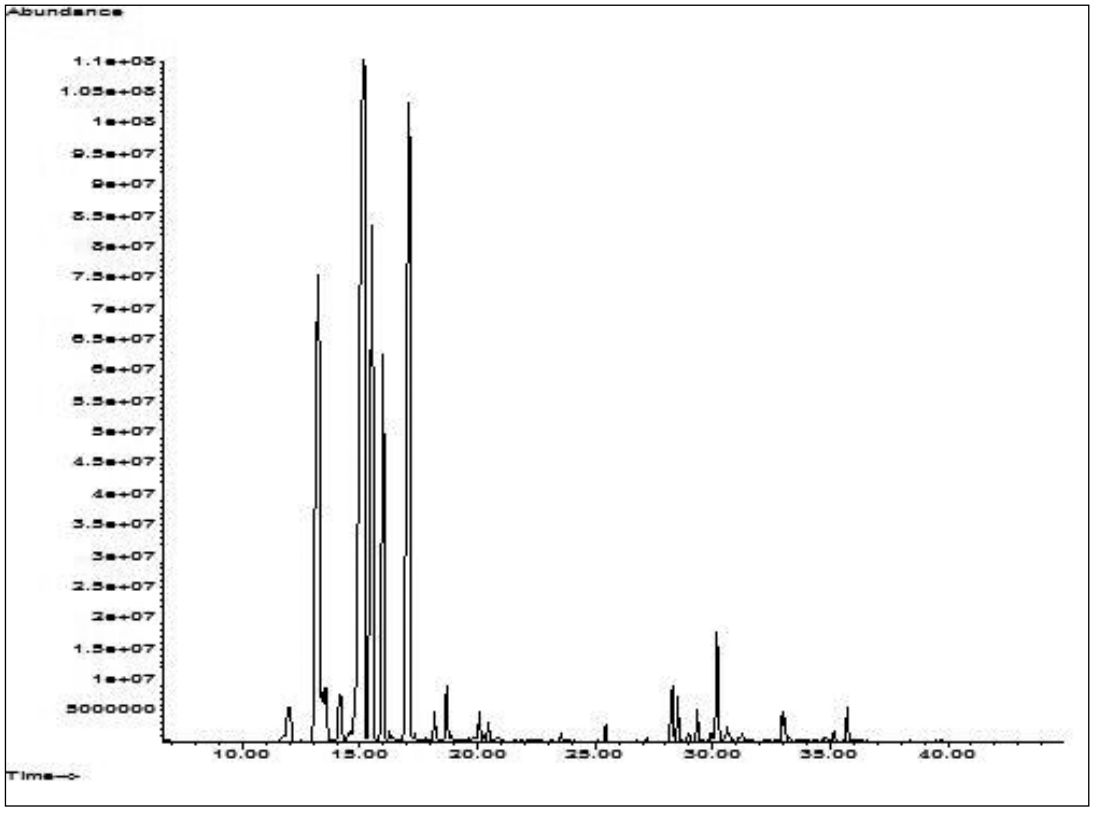

Figure 1. Chromatogram of essential oil of *H. platytaenium.*

min to 240 ^{0}C at a rate of 5 ^{0}C/min. Alkanes were used as reference points in the calculation of relative retention indices (RRI). MS were taken at 70 EV and at a mass range of 35–425. Component identification was carried out using spectrometries electronic libraries (WILEY, NIST). The identified constituents of the essential oils are listed in Table 1. The chromatogram was obtained and it is shown in Figure 1.

3. Results

In this study, the chemical composition of the volatile metabolites of *H. platytaenium* collected during the flowering period in Sinop, Turkey. Essential oil of dried aerial parts of *H. platytaenium* was analyzed by GC and GC-MS in terms of their chemical composition. The essential oil yields of *H. platytaenium* was (0.5%) (v/w). The results of the analysis of essential oils of *H. platytaenium* are presented in Table 1 and in Figure 1. 27 compounds were identified, representing 98.1% of the *H. platytaenium*, essential oil (Figure 1). While Limonene was determined to be present at a high percentage (30.8%), Terpinolene (17.9%), β-Pinene (16.3%) and Ocimene (12.6 %) were also determined as the major compounds in the oil profile (Table 1).

4. Discussion

In the studies of Akçin et al. (2013), Iscan et al.(2004), Özek et al. (2005), Kürkçüoğlu et al. (1995), identified components in the essential oils of *H. platytaenium* were determined as 95.2%, 96.4%, 99.0%, 94.3% and 93.9% respectively. In our study, essential oil of *H. platytaenium* was reported 98.1%.

Table 1. Chemical constituents of the essential oils of *H. platytaenium.*

Peak No	RRI	Compounds	Percent (%)
1	1112	α-Pinene	1.4
2	**1140**	**β-Pinene**	**16.3**
3	1147	β-Myrcene	1.3
4	1160	α-Phellandrene	1.3
5	1169	α-Terpinene	0.2
6	**1181**	**Limonene**	**30.8**
7	**1190**	**Ocimene**	**12.6**
8	1200	γ-Terpinene	7.4
9	**1225**	**Terpinolene**	**17.9**
10	1230	4-Thujanol	0.1
11	1248	allo-Ocimene	0.5
12	1260	1,3,8 -p-Menthatriene	1.0
13	1290	4-Carvomenthenol	0.4
14	1298	Cryptone	0.3
15	1366	Lavandulyl acetate	0.1
16	1386	Elixene	1.0
17	1471	Caryophyllene	1.1
18	1494	Humulene	0.4
19	1507	Curcumene	0.1
20	1512	β-Cubebene	2.0
21	1522	γ-Gurjunene	0.4
22	1536	delta-Cadinene	0.1
23	1574	4-epi-cubedol	0.4
24	1576	Spathulenol	0.3
25	1613	tau-Cadinol	0.1
26	1622	tau-Muurool	0.1
27	1634	Apiole	0.5
Total			**98.1**

RRI: *Relative Retention Indices.*

Also, octyl acetate was first major component for these studies, but the limonene was first major component in our study.

Bayan et al. (2016) were studied of the chemical componenets of *H. platytaenium* from different location in Turkey and among the detected compounds Myristicin (27.4%), Octyl acetate (25.1%), 1-Octanol (16.9%) and Octyl 2-methylbutyrate (9.8%) were the main compounds of *H. platytaenium*. However, Usjaka et al. (2016) were reported that the major components of *Heracleum verticillatum* and *Heracleum ternatum* collected from Sırbia and Montenegro were β-Pinene *(%* 29.2-47.0), Limonene (%39.5-2.0) and Terpinolene (%9.4-) respectively.

In different studies, Limonene ve β-pinene were determined as major constituents in the essential oil of *Heracleum sphondylium* ssp. *pyrenaicum* (Evergetis et al. 2009). And Terpinolene (%20), Limonene (%11.5) ve β-pinene (%5.6) were reported as main dominant compounds in study of Sefidkon et al. (2004). These results show high degree of compatibility with our study.

The findings showed that the genus *Heracleum* had a considerable variation in essential oil composition and this study demonstrated the occurrence of Limonene (30.8%), Terpinolene (17.9%), β-Pinene (16.3%) and Ocimene (12.6 %) in the Sinop region of northern Turkey. In general, the essential oil composition of *Heracleum* patterns colected from the different region showed that, the genus have Myristicin, Octyl acetate, β-Pinene, Limonene and Terpinolene were the major and predominant compounds. The essential oil compositions of *Heracleum* samples have also shown that they can be used as raw material for medicinal and pharmaceutical purposes and natural product.

5. Acknowledgments

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