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Research Article

Chemical Composition of Essential Oil From Aerial Parts of *Lactuca serriola* L.

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Abstract: The volatile oil of the aerial parts of *Lactuca serriola* L. was obtained by the hydro-distillation method for 3 hours with the Clevenger-type apparatus. The chemical composition of oil was determined by GC-MS analyses. Forty-three constituents were identified in oil (84.3%). Heneicosane (8.4%), (*E*)-β-ionone (6.5%), hexadecanoic acid (6.4%), hexahydrofarnesyl acetone (6.3%), tricosane (5.5%), heptacosane (5.5%), phytol (5.0%) and pentacosane (4.1%) were determined as main compounds in the oil. The oil has saturated *n*-alkane derivatives as a dominant group. To the best of our knowledge, this is the first report on the chemical composition of volatile of *L. serriola* from Turkey.

Keywords: *Lactuca serriola; essential oils; n-alkane derivatives*

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1. Introduction

The genus *Lactuca* L. is annual, biennial, and perennial herbs and members of the Lactuceae tribe of the Asteraceae family. The genus has 113 species and is represented by 8 species in Turkey. *Lactuca serriola* L. (Prickly lettuce) is a biennial plant that grows grassy and rocky slopes, field margin, fallow and cultivated fields throughout Turkey (Davis, 1975). *L. serriola* is called as 'Yabani marul' or 'Eşek helvası' in Turkey. Prickly lettuce has been used as a traditional medicine in Turkey for a long time. For example, the decoction of the plant is used to treatment of liver ailments and stomach pain; the infusion of the plant is used to lowering cholesterol and against hemorrhoids; it is used as a sedative if the leaves are eaten raw (Tuzlacı, 2016). Also, *L. serriola* leaves are consumed as a fresh salad in Turkey (Dogan et al., 2004). The plant has milky latex, which contains 'lactucarium'. Lactucone, lactucin and lactucic acids are found in lactucarium. The lactucarium concentration is low in young plants and is high in flowering period. The lactucarium is used internally as a traditional medicine in the treatment of insomnia, anxiety, neuroses,

hyperactivity in children, dry coughs, whooping cough, rheumatic pain. Also, this milky latex is used as medicine due to anodyne, antispasmodic, digestive, diuretic, hypnotic, narcotic and sedative properties (Elsharkawy and Alshathly, 2013). *L. serriola* had sedative-hypnotic, antipyretic, antibacterial, analgesic, anti-inflammatory, antioxidant, anticancer and smooth muscle activities due to sesquiterpene lactones (e.g. lactucin, lactucone), triterpenoid saponin, phenols, vitamins, beta carotene, iron, flavonoids, and sesquiterpene esters (Balogun et al., 2017; Mojab et al., 2010). Balogun et al. (2017) reported that the aqueous and methanol extracts from the leaf of *L. serriola* had antipseudomonal activity (Balogun et al., 2017). Another study, it was found that *L. serriola* methanol extract possessed spasmogenic, spasmolytic, a bronchodilator, and vasorelaxant activities (Janbaz et al., 2013). The antioxidant and allelopathic activities of essential oil of *L. serriola* were previously studied. The main compounds of oil were isoshyobunone (64.2%), isocembrol (17.3%), and alloaromadendrene oxide-1 (7.3%). The oil showed strong antioxidant and allelopathic activities (Abd-ElGawad et al., 2019). Additionally, the anti-inflammatory activity of *L. serriola* essential oil was investigated. Sesquisabinene hydrate (15.1%), thunbergol (8.9%) and globulol (6.5%) were determined as the main compounds in the oil. The oil displayed good anti-inflammatory activity (Elsharkawy et al., 2014). The essential oil composition and anticancer activity of hexane and methanol extracts of aerial parts of *L. serriola* were studied. The main compounds of oil were α-pinene, limonene, germacrene D, *trans*-β-caryophyllene, caryophyllene oxide, and santolina triene. The cytotoxic activity of hexane and methanol extracts was evaluated against A549, HCT116, HepG2, and MCF7 cell lines. The methanol extract had strong activity against HepG2 and MCF7 cell lines. Also, lupeol, lupeol acetate, germincol, α-amyrin, β-amyrin, oleanane, and germanicen were isolated from methanol extract (Elsharkawy and Alshathly, 2013).

According to our literature survey, the essential oil composition of *L. serriola* showed differences rely on geographical regions. There is no report on the volatile oil composition of *L. serriola* in Turkey. The first purpose of this research was to obtain essential oil from aerial parts of *L. serriola*, and the second purpose was to determine the diversity in the essential oil composition of *L. serriola* and to show that essential oil differences are related to geographical regions.

2. Materials and Methods

2.1. *Plant Materials*

The aerial parts of *L. serriola* were collected in İkitelli-Başakşehir, Istanbul, Turkey on 23 July 2017 by Hüseyin Servi Ph.D. The plant was identified by Ahmet Doğan Ph.D. A herbarium specimen was deposited in the Marmara University Herbarium (Voucher no: MARE22155).

2.2. *Volatile Oil Analyses*

The volatile oil of the aerial part (290 g) of *L. serriola* was obtained by the Clevenger apparatus (3 h) with the hydrodistillation method. The oil was kept with *n*-hexane (1 mL).

2.3. *Gas Chromatography-Mass Spectrometry Analysis*

The oil ingredients were determined by GC-MS using an Agilent 5977 MSD system and operated in EI mode. The volatile oil was injected (1 µL) in splitless mode. MS transfer apparatus and injector temperatures were set at 250°C. In GC-MS analyses, the capillary column type was Innowax FSC (60 m x 0.25 mm, 0.25 µm film thickness) and the carrier gas was helium with a flow rate of 1 mL/min. The oven temperature was arranged to 60°C for 10 minutes and increased to 220°C at 4°C/min, where the temperature kept stable for 10 minutes. Then, the temperature was increased to 240°C at 1°C/min. The conditions of the mass spectra were as following; it was saved at 70 eV. Then, in MS chromatograms, the relative percentages of the compounds that separated from the integration of the peaks were calculated.

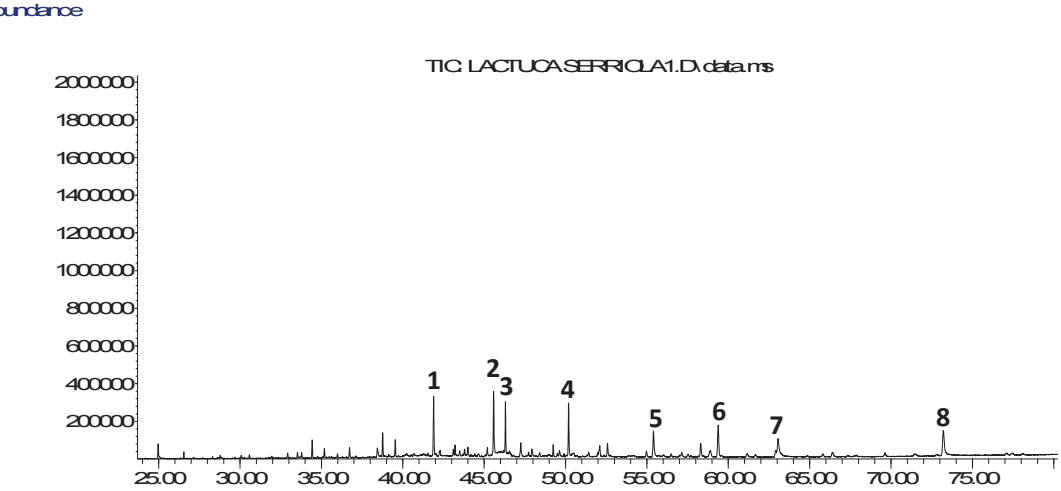
2.4. *Identification of Volatile Oil Components*

The constituents were determined by comparison with GC-MS libraries (Wiley 8th Ed. and NIST 05) and their relative retention indices (RRI) obtained by *n*-alkanes series to the literature.

3. Results and Discussion

The volatile oil yield of *L. serriola* was 0.03% (v/w). Forty-three constituents were identified in oil (84.3%). Heneicosane (8.4%), (*E*)-β-ionone (6.5%), hexadecanoic acid (6.4%), hexahydrofarnesyl acetone (6.3%), tricosane (5.5%), heptacosane (5.5%), phytol (5.0%) and pentacosane (4.1%) were determined as main compounds in the oil. The oil has saturated *n*-alkane derivatives as a dominant group. Other major groups were fatty acid and esters (13.6%) and sesquiterpenoid (9.9%).

Figure 1. GC-MS Chromatogram of *Lactuca serriola* volatile oil



1: (*E*)-β-ionone; **2:** Heneicosane; **3:** Hexahydrofarnesyl acetone; **4:** Tricosane; **5:** Pentacosane; **6:** Phytol; **7:** Heptacosane; **8:** Hexadecanoic acid.

Table 1. The chemical composition of the volatile oil of *Lactuca serriola*

No	RT[1]	RRI[2]	RRI Lit.[3]	Compound	I[4] (%)
1	24.971	1396	1400	Nonanal	1.7
2	28.788	1502	1506	Decanal	0.4
3	30.075	1541	1547	(*E*)-2-Nonenal	0.3
4	30.578	1556	1562	1-Octanol	0.4
5	32.930	1630	1638	β-Cyclocitral	0.5
6	33.532	1650	1655	(*E*)-2-Decanal	0.6
7	33.791	1659	1665	1-Nonanol	0.8
8	34.434	1680	1687	Estragole	1.6
9	35.184	1705	1705	γ-Himachalene	1.1
10	35.988	1733	1737	β-Bisabolene	0.4
11	36.731	1759	1765	(*E*)-2-Undecanal	1.1
12	38.443	1820	1827	(*E*,*E*)-2,4-Decadienal	1.4
13	38.765	1832	1835	β-Damascenone	2.0
14	39.540	1861	1868	*Trans*-geranyl acetone	1.6
15	**41.897**	**1951**	**1958**	**(E)-β-ionone**	**6.5**
16	42.288	1966	1973	Dodecanol	0.8
17	44.001	2035	2041	Pentadecanal	1.3
18	45.197	2084	2100	Zingiberonol	1.6
19	**45.583**	**2099**	**2100**	**Heneicosan**e	**8.4**
20	**46.310**	**2130**	**2131**	**Hexahydrofarnesyl aceton**e	**6.3**
21	47.735	2191	2179	1-Tetradecanol	0.9
22	47.935	2200	2200	Docosane	1.3
23	48.415	2221	2226	Hexadecanoic acid methyl ester	0.6
24	49.245	2258	2262	Hexadecanoic acid ethyl ester	1.1
25	49.631	2275	2296	Decanoic acid	1.0
26	49.904	2287	2299	Isophytol	0.3
27	**50.189**	**2300**	**2300**	**Tricosan**e	**5.5**
28	50.505	2313	2315	2,4-bis(tert-butyl)-phenol	1.0
29	51.874	2371	2380	Hexylcinnamic aldehyde	0.2
30	52.103	2380	2384	Farnesyl acetone	2.0
31	52.580	2400	2400	Tetracosane	1.6
32	54.972	2486	2492	Dodecanoic acid	1.0
33	**55.405**	**2501**	**2500**	**Pentacosan**e	**4.1**

34	56.494	2532	2538	Linoleic acid ethyl ester	0.6
35	57.142	2551	2592	Diisobutyl phthalate	0.9
36	57.526	2562	2582	Eicosanal	0.5
37	58.308	2585	2594	9-Hexacosene	1.9
38	58.901	2602	2613	Ethyl linolenate	1.8
39	**59.382**	**2614**	**2622**	**Phytol**	**5.0**
40	62.915	2698	2713	Tetradecanoic acid	1.1
41	**63.061**	**2701**	**2700**	**Heptacosan**e	**5.5**
42	66.408	2773	2783	1-Docosanol	1.2
43	**73.216**	**2910**	**2931**	**Hexadecanoic aci**d	**6.4**
				n-alkane derivatives	39.7
				Fatty acid and esters	13.6
				Sesquiterpenoid	9.9
				Diterpene	5.3
				Monoterpenoid	4.1
				Sesquiterpene	1.5
				Others	10.2
				Total	**84.3**

[1]RT: Retention time; [2]RRI: Relative retention time; [3]RRI Lit.: Relative retention time in the literature; [4]The analysis results.

According to a study from Saudi Arabia, *L. serriola* essential oil was reported to contain sesquisabinene hydrate, thunbergol and globulol as main compounds (Elsharkawy et al., 2014). Isoshyobunone, isocembrol, and alloaromadendrene oxide were detected in higher quantity in the essential oil of *L. serriola* from Egypt (Abd-ElGawad et al., 2019). Another study from Saudi Arabia, α-pinene, limonene, germacrene D, *trans*-β-caryophyllene, caryophyllene oxide, and santolina triene were found as main compounds in the essential oil of leaves of *L. serriola* (Elsharkawy and Alshathly, 2013). The previous reports indicated that *L. serriola* had sesquiterpenoid, diterpene and oxygenated monoterpene as major groups. In the current study, the aerial part essential oil of *L. serriola* had *n*-alkane derivatives, fatty acid, and esters as dominant groups and showed a dissimilar chemical profile from the previous studies. Sesquiterpenoids were a common major group in present study, similar to previous studies. In the present study, hexahydrofarnesyl acetone was found as the main compound in the sesquiterpenoid group. Also, this compound was detected in the Egypt sample (1.77%) (Abd-ElGawad et al., 2019). However, there is quantitative dissimilarity in the main compound of the sesquiterpenoid group of volatile oil from Turkey and Egypt samples. In the current study, phytol was found as the main compound in the diterpene group. But this compound was not determined in previous studies. The difference may be correlated with the geographical region, collection time and specific climate conditions.

Conclusion

The chemical composition of the essential oil of *L. serriola* from Turkey was determined. The current research revealed that *L. serriola* oil was rich in *n*-alkane derivatives and showed variations in the main compounds due to geographical regions compared to previous studies.

Conflict of Interests

The authors declare no conflict of interest.

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