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Chemical composition of Elamit Scrophularia deserti

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Abstract: *Scrophularia deserti* is an annual and perennial herb, as well as a genus of shrubs. Flowers have bilateral or rarely radial symmetry reaching height of 10–50 cm. Leaves of plant are thick, hard, brittle with green color. *S. deserti* plant from the family of Scrophulariaceae is mostly grass or shrub and rarely trees. It has five-pointed flowers, corolla with lobes and the fruits usually have a capsule with multiple seeds. Aerial parts of *S. deserti* were collected during November of 2014 in Dehloran region of Ilam province. After confirming the species and genius of the plant in natural resources research center of Ilam Province, the collected plant was dried in the air and powdered with mixer. Essential oil was extracted and analyzed with gas chromatography/mass spectrometry (GC-MS). Phytochemistry results showed that the most active ingredients of the plant were α-PINENE, β-Phellandrene and β-Myrcene which respectively formed 24.69%, 20.58% and 11.82% of the essential oils of the plant.
Keywords: Plant, Snapdragon, *Scrophularia deserti*, Oil, SPME method, α-PINENE.

Introduction

Scrophulariaceae family include about 268 genera and over 5,100 species. Members of the Scrophulariaceae have a cosmopolitan distribution, with the majority found in high temperate areas, including Arabian Desert and adjacent territory and Touran, including Egypt, Palestine, Jordan, Syria, Iraq, Saudi Arabia, Kuwait, Bahrain and Iran (1). *Scrophularia deserti* is annual and perennial herb, as well as a genus of shrubs. Flowers have bilateral or rarely radial symmetry reaching to 10–50 cm height. Leaves of the plant are thick, hard, brittle with green color. S. deserti plant from the family of Scrophulariaceae is mostly grass or shrub and rarely trees, with five-pointed flowers, corolla with lobes and the fruits are usually in a capsule with multiple seeds. (2, 3). This plant is abundant in most parts of Iran and is called *Scrophularia deserti* sazooei. This plant

has been used in the west region of Iran especially in Ilam province (4). In traditional medicine, local people experimentally use it in some disorders such as internal infections, mastitis, skin ulcers and episiotomy, inflammation, burns, intestinal pain, inflammation, eye and ear infections and hemorrhoids in the form of decoction by oral or topical uses (5,6). Chemical analysis of snapdragon was performed previously, but the plant essential oil chemical analysis has not been reported. In this study, for the first time chemical analysis of essential oil was examined and reported.

Table 1. Scrophularia deserti plant

Species	Plant family	Region	Province	Latitude	Longitude	Altitude (m a.s.l)	Used part
Scrophularia deserti	Scrophulariaceae	Dehloran city	Ilam (West of Iran)	58◦26 N	13◦33 E	683-790	Aerial organs

Methods

Preparation of medicinal plants

Specimens of the species of snapdragon were taken from different parts of Ilam province during 22 to 30 November 2014 (Table 1). Oregano plant shoots of 10 samples were collected. From the aerial parts of the plant ten samples were collected. The collected plant was submitted to Natural Resources Research Center of Ilam province and the plant was identified and the essential oils were determined (table 1)

Gas chromatography/mass spectrometry (GC–MS) analysis

The essential oils were analyzed using an Agilent 6890N coupled to Agilent 5973 mass detector gas chromatograph (Agilent, USA) with a HP-5MS 5% phenylmethylsiloxane capillary column (HP-5, 30m (length) × 0.25 mm (ID) × 0.25 µm (stationary phase thickness)). Oven temperature was kept at 55 ◦C for 4 min initially, and then raised at the rate of 4 ◦C/min to 250 ◦C. Injector temperature was set at 250 ◦C, respectively. Helium (99.999%) was used as carrier gas at a flow rate of 0.9 ml/min; samples were injected manually in the split mode. The peaks area percent was used for obtaining quantitative data. The gas chromatograph was coupled to an Agilent 6890N coupled to Agilent 5973 mass detector mass selective detector. Retention indices were calculated for all components using a homologous series of n-alkanes (C5–C24) injected in conditions equal to samples. Identification of oil components was accomplished based on comparison of their retention times with those of authentic standards and by comparison of their mass spectral fragmentation patterns (WILLEY/ChemStation data system)

The characteristics of the instrument were as follow:
Instrument: Gas chromatograph: Agilent 6890N coupled to Agilent 5973 mass detector
Column: HP-5, 30m (length)× 0.25 mm (ID) × 0.25 µm(stationary phase thickness)
Injector type: split/ splitless

Column temperature program:

Rate(^{0}C/min)	Temperature (^{0}C)	Hold (min)
-	50	-
5	180	-
10	250	0.00

Carrier gas: He (99.999%); Injection type: splitless; Library: Wiley 7n; Injector temperature: 250˚C; Flow rate: 0.9 ml/min

Extraction condition:
Extraction mode: Head space solid phase microextraction (HS-SPME)
SMPE fiber: PDMS 100 µm thickness (SUPELCO)

Sample weight: 0.5 gr, Extraction temperature: 60 ˚C, Extraction time: 15 min, Sonication time: 10 min (Euronda sonication instrument, Italy), Humidity (added water volume): 50 µL, Desorption time in injector port of GC-MS: 3 min.

Results

GC-MS results showed that the *Scrophularia deserti* plant contains 51 compounds. Phytochemistry laboratory analyses results are shown in Table 2.

Table 2. Gas chromatography/mass spectrometry (GC–MS) analysis of *Scrophularia deserti*

No.	Compound	KI	%
1	α-Thujene	920	0.88
2	α-PINENE	931	24.69
3	Sabinene	966	5.81
4	β-Myrcene	988	11.82
6	Tricyclene	997	0.94
7	β-Phellandrene	1035	20.58
8	3-Carene	1046	0.37
9	ɤ-Terpinene	1054	0.28
10	trans-Sabinene hydrate	1068	0.27
13	Alloocimene	1176	0.75
14	Camphor	1224	0.68
17	Fenchyl acetate	1285	2.25
20	Octadecane	1289	0.18
21	Borneol, acetate	1296	2.98
27	Bicycloelemene	1325	1.14
30	α-Copaene	1378	2.24
31	Calarene	1386	1.48
32	β- BOURBONENE	1392	0.26
35	α-Gurjunene	1406	0.29
37	trans-Caryophyllene	1418	9.22
39	α-Bergamotene	1436	1.03
40	Isoledene	1449	0.49
41	trans-β-Farnesene	1468	3.14
43	α-amorphene	1474	0.40
44	β-Cubebene	1485	2.38
46	bicyclogermacrene	1492	1.57
47	β-Bisabolene	1512	0.61
48	Germacrene D	1526	1.15
49	δ-Cadinene	1538	1.88
51	Docosane	1568	0.25

Discussion

The results of a phytochemical study showed that, α-PINENE with 24.69% is the most active ingredient of *Scrophularia deserti* plant. Phytochemical analysis revealed that *Scrophularia deserti* extracts containing compounds 3 (zeta) -hydroxy-octadeca-4 (E), 6 (Z) -dienoic acid (1). The known compounds are ajugoside (2), scropolioside B (3), 6-O-alpha-L-rhamnopyranosylcatalpol (4), buddlejoside A (8) (5), scrospioside A (6), laterioside and 3R-1 -octan-3-yl-3-O-beta-D-glucopyranoside (7). *Scrophularia deserti* is a plant which in traditional medicine, local people experimentally use it in internal infections, mastitis, skin ulcers and episiotomy, inflammation, burns, intestinal pain, inflammation, eye and ear infections and hemorrhoids in the

form of decoction by oral or topical uses (5,6). This plant has phenolic compounds and phenolic compounds have antimicrobial activities (8-13). More importantly these compounds have antioxidant activities which possess various therapeutic effects, especially in diabetes (14-17), hyperlipidemia (18-20), renal toxicities (21-35), and pain (36-39). Therefore, this plant might have these properties, too. There are many therapeutic effects of medicinal plants due to pharmaceutical active substances such as phenols, flavonoids, tannins, anthocyanin and etc (40-55).

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