
Research Article

Composition of the Essential oil of *Haplophyllum affine* (Aitch. et Hemsl.) Korov

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ARTICLE INFO:

Received:
25 July 2024

Accepted:
30 September 2024

Available online:
7 October 2024

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ABSTRACT

Haplophyllum is a genus of flowering plants belonging to the family *Rutaceae*. It is the only genus in the subfamily Haplophylloideae. In spite of various researches on *Haplophyllum* species essential oils, there was no report on *Haplophyllum affine*. In this article volatile components of this Iranian endemic species is informed for the first time. The essential oil obtained by hydrodistillation from flowering aerial parts of *Haplophyllum affine* was analyzed using gas chromatography (GC) and gas chromatography–mass spectrometry (GC–MS). Seventeen constituents constituting 98.48% of the total oil were detected. The major ingredients were Elemol (25%), Caryophyllene oxide (17%), Phytol acetate (9.2%), 14-hydroxy -9-epi-E- Caryophyllene (7.16%), Eudesmol- α (6.08%) and Caryophyllen- β (6%).

Keywords: Essential oil; GC-MS; *Haplophyllum affine*; Elemol; Caryophyllene oxid.

1. Introduction

The family Rutaceae consists of 150 genera and 900 species which distributed throughout temperate and tropical regions [1]. The genus *Haplophyllum* A. Juss. belongs to Rutaceae family and comprises nearly 70 species which mainly dispersed around the Mediterranean

region of Europe and through western Asia up to Siberia [2-3]. Eighteen species of *Haplophyllum* A. Juss. Genus grows in Iran which among them nine species are endemic and *Haplophyllum affine* (Aitch. et Hemsl.) Korov. is one of them [4-5]. According to the literature survey, essential oil compositions of various species of *Haplophyllum* A. Juss. Genus was previously reported. The yield and constitution of these species volatile oils depend upon the organ type and plant origin [6-15]. Despite the several researches on *Haplophyllum* species essential oils, there was no study on *Haplophyllum affine* (Aitch. et Hemsl.) Korov. And this paper is the first investigation on volatile constituents of this endemic species.

2. Materials and methods

2.1. Plant materials

The flowering aerial parts of *Haplophyllum affine* (Aitch. et Hemsl.) Korov. Were collected in Apr 2014 from Khorassan (Khorassan: NE: E Salehabad, between Saghar-Cheshmeh and Garmab-e Olia, 550 m, 25.4.2007, Iran).

2.2. Isolation of the essential oil

The air-dried crushed flowering aerial parts of *Haplophyllum affine* (Aitch. et Hemsl.) Korov. Were subjected to hydrodistillation using a Clevenger-type apparatus for 4 hrs. The obtained volatile oil was dried over anhydrous sodium sulphate and stored at 4-6 °C.

2.3. Essential Oil Analyses

Chemical composition of the oil was investigated by gas chromatography (GC) and gas chromatography–mass spectrometry (GC–MS). *Haplophyllum affine* (Aitch. et Hemsl.) Korov. Volatile oil was analyzed by GC–MS using a Hewlett-Packard 6890 gas chromatograph with DB-5 capillary column (30 m x 0.25 mm; film thickness 0.25 μm). The carrier gas was helium with a flow rate of 1 ml/min. The column temperature was programmed from 60 °C to 220 °C at 60 °C/min. The gas chromatograph was coupled to a

Hewlett-Packard 5973 mass selective detector. The MS was operated at 70eV ionization energy. The retention indices were calculated by using retention times of n-alkanes that were injected after the essential oil at the same conditions. The components were identified by comparison of retention indices with those reported in the literatures and also by comparison of their mass spectra with the published spectra or Wiley library [16-17]. Gas chromatography using flame ionization detection (GC–FID) analysis was carried out under the same experimental conditions with the same column as described for the GC–MS. The relative percentage of the identified compounds was computed from the GC peak area without applying correction factors.

3. Result and discussion

The dried flowering aerial parts of *Haplophyllum affine* (Aitch. et Hemsl.) Korov. Yielded 0.46% V/W of a light-yellow essential oil. Seventeen constituents constituting 95.7% of the total oil were identified. Aerial parts volatile oil and their main compounds were determined as follows: Elemol (25%), Caryophyllene oxide (17%), Phytol acetate (9.2%), 14-hydroxy - 9-epi-E- Caryophyllene (7.16%), Eudesmol- α (6.08%) and Caryophyllen- β (6%). *Haplophyllum affine* (Aitch. et Hemsl.) Korov. Volatile compositions of many species of the genus *Haplophyllum* A. Juss. Were previously studied which depend on various factors such as geographic distribution, seasonal variation, phenological cycle, plant organ, genetic and analytical method used. Essential oil components that have been often informed from *Haplophyllum* species comprise monoterpenoid compounds as the major ingredients [6-15]. Reviewing literature revealed that there was no report on volatile constituents of *Haplophyllum affine* (Aitch. et Hemsl.) Korov. and this article is the first research on this is endemic species.

Table 1. Volatile constituents of *Haplophyllum affine* (Aitch. et Hemsl.) Korov. (*Ruta affinis* Aitch. et Hemsl.; *H. badghysi* Eug. Kor.)

No	Compound	%	KI	MS-KI
1	dihydroedulan II	2.03	1284	MS-KI
2	Copaene- α	0.62	1376	MS-KI
3	Caryophyllen- β	6	1419	MS-KI
4	Humulene- α	1.05	1454	MS-KI
5	Elemol	25	1549	MS-KI
6	Caryophyllenyl alcohol	1.91	1572	MS-KI
7	Caryophyllene oxide	17	1583	MS-KI
8	Eudesmol- γ	5.37	1632	MS-KI
9	Caryophylla-4(12),8(13)-dien-5 α -ol	6	1640	MS-KI
10	Eudesmol- β	5.57	1650	MS-KI
11	Eudesmol- α	6.08	1653	MS-KI
12	14-hydroxy -9-epi-E- Caryophyllene	7.16	1669	MS-KI
13	Hexa-hydrofarnesyl acetone	1.42	1922	MS-KI
14	Phytol	0.73	1943	MS-KI
15	Phytol acetate	9.2	2218	MS-KI
16	Palmitic acid	2.41	2025	MS-KI
17	Dotriacontane	0.84	3200	MS-KI
Total		98.48		

^a Retention indices; relative to n-alkane series on DB-5 capillary column. ^btrace (<0.05%).

References:

- [1] VH Heywood. Flowering Plants of the World, Oxford University Press, London, 1978.
- [2] JC Willis. A Dictionary of Flowering Plants and Ferns, 8th ed, revised by HK Airy Shaw, Cambridge University Press, Cambridge, 1980; 532.
- [3] CC, Townsend. Taxonomic revision of the genus *Haplophyllum* (Rutaceae), In: Hooker's Icones Plantarum, Vol. 25. Parts I, II and III, Bentham-Moxon Trustees, Kent, UK, 1986.
- [4] V Mozaffarian. A Dictionary of Iranian Plant Names, Farhang Moaser, Tehran, Iran, 2003; 260-262.
- [5] KH Rechinger. *Haplophyllum*. In Flora Iranica, Rutaceae. No. 36. (Eds.: KH Rechinger, IC Hedge), Akademische Druck- u. Verlagsanstalt, Graz, Austria, 1966.
- [6] MB Gholivand; M Rahimi-Nasrabadi; H Batooli; et al. Nat. Prod. Res, 2012, 26(10), 883891.
- [7] A Bamoniri; BBF Mirjalili; A Mazoochi; et al. Dig. J. Nanomater. Bios, 2010, 5(1), 169 172.
- [8] M Rahimi-Nasrabadi; MB Gholivand; H Batooli; et al. Dig. J. Nanomater. Bios, 2009, 4(4), 819-822.
- [9] A Bamonieri; J Safaei-Ghomi; H Asadi; et al. J. Essent. Oil Res, 2006, 18(4), 379-380.
- [10] K Javidnia; R Miri; A Banani. J. Essent. Oil Res, 2006, 18(4), 355-356.
- [11] SKS Al-Burtomani; MO Fatope; RG Marwah; et al. J. Ethnopharm, 2005, 96(1-2), 107 112.
- [12] Sh Masoudi.; A Rustaiyan; P Aberoomand Azar. J. Essent. Oil Res, 2004, 16(6), 548 549.
- [13] KH Kubeczka; W Schultze; P Torres; et al. J. Essent. Oil Res, 2003, 15(1), 41-43.
- [14] H Saglam; T Gözler; B Kıvçak; et al. Chem Nat. Comp, 2001, 37(5), 439-441.

- [15] M Yari; Sh Masoudi; A Rustaiyan. *J. Essent. Oil Res*, 2000, 12(1), 69-70.
- [16] RP Adams. *Identification of Essential Oil Components by Gas Chromatography/ Quadrupole Mass Spectroscopy*, Allured Publishing Corporation, Illinois, USA, 2001.
- [17] Y Massada. *Analysis of Essential Oil by Gas Chromatography and Mass Spectrometry*, John Wiley & Sons Inc., New York, 1976.