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Original Article

Volatile Constituents of Aerial Parts of *Euphorbia aellenii* Rech.f. and *E. microsciadea* Boiss. from Iran

Suleiman Afsharypuor[a,*], Abdul Majid Ayatollahi[b], Muhammad Iqbal Choudhary[c], Mustafa Ghanadian[a]

[a]*Faculty of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, I.R. Iran*
[b]*School of Pharmacy, Shaheed Beheshti University of Medical Sciences, Tehran, I.R. Iran*
[c]*International Institute for Chemical Sciences, HEJ Research Institute of Chemistry, University of Karachi, Karachi, Pakistan*

Abstract

The volatile constituents of aerial parts of *Euphorbia aellenii* Rech.f. and *E. microsciadea* Boiss. were analyzed by gas chromatography (GC) and GC-mass spectrometry (MS) methods. The main volatile constituents of *E. aellenii* were phytol isomer (47.3%), camphene (31.9%) and caryophyllene oxide (20.6%), while the major volatile components of *E. microsciadea* were *trans*-anethole (74.5%), limonene (7.7%), hexadecanoic acid (6.8%), fenchone (6.0%) and phytol isomer (4.9%).

Keywords: *trans*-Anethole; Camphene; Caryophyllene oxide; *Euphorbia aellenii*; *Euphorbia microsciadea*.
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1. Introduction

Euphorbia aellenii Rech.f. and *E. microsciadea* Boiss. (Euphorbiaceae) are two perennial plants grow in some parts of Iran [1-3].

Analysis of the essential oil of *E. teheranica* Boiss. growing in Tehran region and semi-desert areas of central Iran has been done by other researchers [4]. On the other hand, sporadic occurrence of the glucosinolates in the Euphorbiaceae was claimed by some authors [5]. To the best of our knowledge, there has been no report regarding the volatile terpenoids and/or volatile degradation products of the glucosinolates in *E. aellenii* and *E. microsciadea*. In the present study, the two above mentioned Iranian *Euphorbia* species were investigated for their volatile constituents. The volatile components of the aerial parts of the flowering plants were prepared and determined by gas chromatography (GC) and GC-mass spectrometry (MS).

*Corresponding author: Prof. Suleiman Afsharypuor, Faculty of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, I.R. Iran.
Tel.: (+98)311-792 2637; Fax.: (+98)311-6680011
E-mail: afsharypuor@pharm.mui.ac.ir

2. Materials and methods

2.1. Plant material

Aerial parts of the flowering plants of *E. aellenii* Rech. f. and *E. microsciadea* Boiss. were collected in August 2007 from populations growing in Galil-e-Shirvan (near to Turkmenistan border), Northern Khorasan province (Iran). The plants were identified

Table 1. Volatile constituents of aerial parts of *Euphorbia aellenii* and *E. microsciadea* from Iran.

Components	**Retention indices**	***E. aellenii* (%)**	***E. microsciadea* (%)**
α-Pinene	940	t*	t
Camphene	955	31.9	-
β-Pinene	979	t	-
ortho-Cymene	1028	-	t
Limonene	1031	-	7.7
δ-3-Carene	1033	t	-
Fenchone	1090	-	6.0
trans-Anethole	1287	-	74.5
(E)-β-Ionone	1489	t	-
Caryophyllene oxide	1584	20.6	-
Hexadecanoic acid**	1979	t	6.8
Phytol isomer	2117	47.3	4.9
Grouped constituents:			
Monoterpene hydrocarbons		31.9	7.7
Oxygenated monoterpenoids		-	80.5
Oxygenated sesquiterpenoids		20.6	-
Oxygenated diterpenoids		47.3	4.9
Others		t	6.8
Total identified		99.8	99.9

*t = trace (less than 0.1%); ** Also known as palmitic acid.

by the Department of Botany, Herbaceous Sciences Research Center at the Ferdowsi University, Mashhad, Iran. Voucher specimens of the plants (no. 2023 and 2024) were deposited in the Herbarium of the Pharmacognosy Department, Faculty of Pharmacy and Pharmaceutical Sciences at the Isfahan University of Medical Sciences, Isfahan, Iran.

2.2. Isolation of the volatile constituents

As the amounts of the volatile constituents in both examined plants were little, and because of the possible occurrence of some glucosinolate compounds in the plants, which on hydrolysis offer volatile degradation products, therefore, the following method was selected to prepare and isolate the volatile constituents: Dried powdered aerial parts of each flowering plant were mixed with distilled water, covered by a layer of cyclohexane and left at room temperature overnight. Then the mixture was shaken for 5 min. and the volatile constituents were collected by distillation [6]. The distillate was then concentrated under a stream of nitrogen gas and analyzed.

2.3. GC analysis

GC determinations were run on a Perkin Elmer 8500 instrument using a BP1 capillary column (30 m×0.25 mm; film thickness: 0.25 µm). The carrier gas was nitrogen with a flow rate of 2 ml/min. The oven temperature was programmed from 60-275 °C at 4 °C/min. Injector and detector temperatures were 275 and 280 °C, respectively.

2.4. GC/MS analysis

Analysis of the volatile constituents was performed on a Hewlett Packard 6890 GC/MS instrument under the following conditions: injection of 0.1 µl samples, HP-5 MS capillary column (30 m×0.25 mm; film thickness 0.25 µm); carrier gas He, flow rate 2 ml/min., injector temperature 250 °C, temperature program: 60-275 °C at 4 °C/min.; mass spectra: electronic impact, ionization potential 70 eV, ion source temperature 250 °C,

ionization current 1000 μA, resolution 1000, and mass range 30-300.

Identification of the constituents was based on computer matching against the library spectra (Library Database Wiley 275), their retention indices with reference to an n-alkane series in a temperature programmed run, interpreting their fragmentation pattern and comparison of the mass spectra with the literature data [7].

3. Results and discussion

Eight volatile constituents in the aerial parts of *E. aellenii* and seven components in *E. microsciadea* were identified (Table 1). Phytol isomer (47.3%), camphene (31.9%) and caryophyllene oxide (20.6%) were the main constituents of *E. aellenii*. Other identified compounds were in trace amounts. Thus the volatiles were dominated by the oxygenated diterpenoid, namely phytol isomer. On the other hand, the major components of *E. microsciadea* were trans-anethole (74.5%), limonene (7.7%), hexadecanoic acid (6.8%), fenchone (6.0%) and phytol isomer (4.9%). Two monoterpene hydrocarbons were also identified among other volatiles but were presented only in less than 0.01%. Thus the volatiles of this plant were dominated by the oxygenated monoterpenoid (i.e. fenchone). However, Feizbakhsh and his co-researchers [4] who analyzed the volatile constituents of *E. teheranica* Boiss. growing in north of Tehran, Karadj area, between Maahshahr and Eshtehard, reported that their examined oil was dominated by elemol (57.5%), with lesser amounts of β-caryophyllene (8.1%) and caryophyllene oxide (7.8%). They concluded that the oil of *E. teheranica* was rich in sesquiterpenes (86.1%), mostly oxygenated sesquiterpenes.

Unlike plants investigated in this research, which were relatively rich in monoterpenoids (31.9% in *E. aellenii* and 94.5% in *E. microsciadea*), the monoterpene fraction of *E. teheranica* was relatively small and representing only 4.6% of the total oil [4]. No volatile glucosinolate degradation products, i.e. isothiocyanates, nitriles, etc., could be detected among the volatiles in *E. aellenii* and *E. microsciadea*. However, Evans claimed that the glucosinolates occur sporadically in the Euphorbiaceae [5].

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