Chemical Composition of the Essential oil from Aerial Parts of *Echinophora platyloba* DC. from Iran

Rahimi-Nasrabadi M (Ph.D student)[1,2*], Gholivand MB (Ph.D.)[2], Niasari M (M.Sc.)[3], Vatanara A (Ph.D.)[4]

1- Department of Chemistry, Imam Hossein University, Tehran, Iran
2- Department of Chemistry, Razi University, Kermanshah, Iran
3- Department of Chemistry, Islamic Azad University, Shahreza Branch, Shahreza, Iran
4- Department of Pharmaceutics, School of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran
*Corresponding author: Department of Chemistry, Imam Hossein University, Tehran, Iran
Tel: +98 8317243399, Fax: +98 8314229172
Email: rahiminasrabadi@gmail.com

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Abstract

Background: Essential oils and various extracts from plant are of great interests in the industry and scientific research.

Objective: This study was designed to examine the chemical composition of essential oil and of *Echinophora platyloba* from Iran.

Method: The chemical composition of the hydrodistilled essential oil of the air-dried aerial parts of *Echinophora platyloba* growing wild in Iran was obtained by hydrodistillation and was analyzed by gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS).

Results: The species is poor in essential oil (yield = 0.7%). Twenty-nine constituents representing 97.43% of total oil have been identified. The main constituents of the oil were found to be (Z)-β-ocimene (26.71%), Δ-3-carene (16.16%), Limonene (6.59 %). Other representative compounds were identified as Cis-3-hexylbenzoate (4.57%), Spathunenol (4.57%), Myristicin (4.48 %), Myrcene (4.31%), 4-decanolide (4.2%) and α-Pinene (4.03 %).

Conclusion: The oil of *Echinophora platyloba* consists of 16 monoterpenoids (69.55%) and 5 sesquiterpenoids (7.08%).

Keywords: ***Echinophora platyloba,*** **Umbelliferae, essential oil, z-β-ocimene, Δ-3-carene**

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Introduction

Essential oils and extracts obtained from many plants have recently gained popularity and scientific interest. Many plants have been used for different purposes, such as food, drugs and perfumery [1]. Researchers have been interested in biologically active compounds isolated from plant species for the elimination of pathogenic microorganisms because of the resistance that microorganisms have built against antibiotics [2].

The genus Echinophora (Umbelliferae, subfamily Apioideae, tribe Echinophoreae), is represented in the flora of Iran by four species including two endemics. These are: *E. sibthorpiana* Guss., *E. orientalis* Hedge et Lamond and two endemic species: *E. platyloba* DC. and *E. cinerea* (Boiss.) Hedge et Lamond [3]. In Iran, fresh and dried aerial parts of some these species are added to cheese and yoghurt for flavoring, *Echinophora platyloba* is used in folk medicine, as a food seasoning. The Mediterranean and Middle East regions seem to be the only areas where this genus is established [4]. The plant is one of the Iranian endemic species, which could be found in different part of central and western provinces of Iran. The Persian name of the plant is "Khosharizeh" [3].

Materials and methods

Plant material

Plant material was collected in June of 2008 in around Shalamzar, Province of Isphahan, Iran. Immediately prior to the extraction process; the arial part of each sample was ground in a blender to produce a powder with an approximate size of 0.4 mm.

Extraction of the essential oil

The essential oils were extracted by hydrodistillation of dried plant material for 8 h (60 g of sample in 500 mL of distilled water) using a Clevenger-type apparatus as recommended by British Pharmacopeia [5]. The oils were dried over anhydrous sodium sulphate and stored in sealed glass vials at 4-5°C prior to analysis. Yield based on dry weight of the sample was calculated.

Analysis of the essential oils

GC-MS analysis of the essential oils were performed using an HP-6890 GC system coupled with a 5973 network mass selective detector and equipped with a HP5-MS capillary fused silica column (60 m, 0.25mm I.D.; 0.25µm film thickness). Essential oil solution (1 μL) in hexane (HPLC grade) was injected and analyzed with the column held initially at 40 ℃ for 1 min and then increased to 250 ℃ with a 3 ℃/min heating ramp and subsequently kept at 250 ℃ for 20 min. Other operating conditions were as follows: carrier gas, He (99.999%); with a flow rate of 1 ml/min; injector temperature, 250 °C; split ratio, 1:50. Mass spectra were taken at 70 eV. Mass range was from *m*/*z* 20 – 500 amu. Oil constituents were identified by comparing linear retention indices based on a homologous series of even numbered n-alkanes (C8–C24) (Niles, Illinois, USA) with those of standard compounds and by comparison with literature data and MS data with those of reference compounds (Sigma – Aldrich and Acros Organics) and by MS data obtained from Wiley and NIST libraries [6, 7]. Relative percentage amount were calculated from TIC by the computer.

Results

The hydrodistillation of the flowering aerial parts of *E. platyloba* gave light yellowish oil with yield of 0.7% (w/w). The identified constituents from the aerial parts of

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E. platyloba, their retention indices and their percentage composition are summarised in Table 1. All the compounds are arranged in order of their elution from the HP5-MS column. A total of 29 compounds have been identified representing around 97.43% of the total oil. (Z)-*β*-ocimene (26.71%), Δ-3-carene (16.16%), Limonene (6.59 %) were major constituents in the volatile oil of *E. platyloba*. Other representative compounds were identified as cis-3-hexylbenzoate (4.57%), spathunenol (4.57%), myristicin (4.48 %), myrcene (4.31%), 4-decanolide (4.2%) and *α*-pinene (4.03 %). Our results show that the oil contains about 62.09% monoterpene hydrocarbons and (7.46%) oxygenated monoterpenes. The concentration of sesquiterpene hydrocarbons and oxygenated sesquiterpenes is relatively low (1.63 and 5.45% respectively). The oil of *E. platyloba* consists of 16 monoterpenoids (69.55%) and 5 sesquiterpenoids (7.08%). The essential oil of *Echinophora platyloba* is rich in monoterpenoids.

Table 1- Essential oil composition of *Echinophora platyloba*.

Compound[a]	RI[b]	This work Area (%)[c]	Ref. 4	Ref. 8
2-butenal	870	-	1.8	
α-Pinene	936	4.03	-	6.0
Sabinene	969	0.58	-	
Myrcene	981	4.31	6	
α-phellandrene	1001	1.82	-	
Δ-3-carene	1010	16.16	-	
p-cymene	1015	1.89	1.2	
Limonene	1025	6.59	1.5	
(Z)-*β*-ocimene	1040	26.71	2.3	
trans-*β*-ocimene	1047	-	67.9	
(E)-*β*-ocimene	1050	-	-	49.9
Linalool	1084	2.44	3.1	5.6
trans-epoxy ocimene	1121	0.51	-	
Dill ether	1140	0.61	-	
p-mentha-1,5-diene-8-ol	1143	0.76	1.5	
α-terpineol	1176	0.98	-	
Eucarvone	1187	0.63	-	
cis-3-hexenyl-2-methyl butanoate	1214	1.24	2.0	
Cis-3-hexenyl isovalerate	1216	0.72	-	
Geranial	1243	0.29	-	
α-terpinenyl acetate	1335	0.72	-	
Methyleugenol	1369	2.22	-	
4-decanolide	1429	4.2	-	
2-furanone	1466	-	6.2	
γ-decalactone	1467	-	-	8.4
Ar-curcumene	1473	0.54	-	
Myristicin	1492	4.48	-	
β-bisabolene	1503	1.09	-	
Ledane	1511	0.37	-	
Cis-3-hexylbenzoate	1548	4.57	-	
Spathunenol	1577	4.57	-	
Caryophyllene oxide	1583	0.51	-	
δ-dodecalactone	1642	1.27	-	
Palmitic acid	1938	2.62	-	
unknown	-	-	6.5	
Grouped components				
Monoterpene hydrocarbons		62.09		
Oxygenated monoterpenes		7.46		
Sesquiterpene hydrocarbons		1.63		
Oxygenated sesquiterpenes		5.45		
Other		20.8		
Total		97.43		

[a]Order of elution on HP5-MS
[b]Retention indices
[c]tr = trace, less than 0.05%

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Discussion

A report from Mazloomifar et.al indicated that the (E)-*β*-ocimene (49.9%) was the main constituent of the oil, followed by *γ*-decalactone (8.4%), *α*-pinene (6.0%) and linalool (5.6%) [4]. In other report major components of the oil were reported as be trans-*β*-ocimene (67.9%), 2-furanone (6.2%), myrcene (6.0%), linalool (3.1%), and cis-*β*-ocimene (2.3%) [8]. The major components of essential oil of *E. platyloba* in our study were (Z)-*β*-ocimene (26.71%), Δ-3-carene (16.16%), limonene (6.59 %), cis-3-hexylbenzoate (4.57%), spathunenol (4.57%), myristicin (4.48 %), myrcene (4.31%), 4-decanolide (4.2%) and *α*-pinene (4.03 %). Also Asghari et al. [8] identified only 13 component in theirs oil whereas 29 component identified in our oil. According to Mazloomifar et.al. [4], (E)-*β*-ocimene (49.9%) and *γ*-decalactone (8.4%) were among the main components of *E. platyloba*, whereas they were not detected in the present study. These differences especially between amounts of various type of ocimene in different reports might have been derived both from harvest time and local, climatic and seasonal factors or we may hypothesize that these sample belongs to a different chemotype. However, further investigations are needed to elucidate this hypothesis. According to different activities of various compounds, these differences between constituents of the essential oil will be important in nutritional and medicinal uses.

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