

Chemical Constituents of the Essential Oil of *Chaerophyllum Macropodium* Boiss. from Iran

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Abstract:

Introduction: The genus *Chaerophyllum* is comprised of about 110 species; eight are described in the flora of Iran, among which two are endemic. The family Umbelliferae is rich in secondary metabolites and embodies numerous genera of high economic and medicinal value yielding flavonoids, coumarins, acetylenes, terpenes and essential oils.

Aim: Investigation and identification of chemical compositions of the essential oil from *Chaerophyllum Macropodium* Boiss. and determining of essential oil yields.

Materials and Methods: Water-distilled essential oil from the aerial parts of *Chaerophyllum macropodium* Boiss. was analyzed by Gas Chromatography (GC) and Gas Chromatography – Mass Spectroscopy (GC/MS) methods.

Results: The yield of essential oil was 0.3%(W/W) and twenty – three constituents representing 97.0% of the oil were characterized of which β -caryophyllene (21.0%), hexyl octanoate (12.6%) and octyl acetate (11.7%) were the main compounds which were identified.

Conclusion: The essential oil of *Chaerophyllum macropodium* aerial parts is rich in β -caryophyllene, hexyl octanoate and octyl acetate. The oil was richer in sesquiterpenes and oxygenated hydrocarbons than the other compounds.

Keywords: *Chaerophyllum macropodium*, Umbelliferae, Essential oil composition, β - Caryophyllene, Hexyl octanoate, Octyl acetate.

Introduction

The family Umbelliferae is rich in secondary metabolites and embodies numerous genera of high economic and medicinal value yielding flavonoids, coumarins, acetylenes, terpenes and essential oils.⁽¹⁻³⁾ It is well known that occurrence of essential oils and oleoresins is a characteristic feature of this family.^[3] The genus *Chaerophyllum* is comprised of about 110 species, eight are described in the flora of Iran, among which two are endemic: *Ch .nivale* Hedge and Almond and *Ch.khorassanicum* Czern.ex Schischk.^[4, 5]

A few reports on the analysis of the essential oils of *Chaerophyllum* species have been published.^[6-9] In this work, we report on the analysis the essential oil of *Chaerophyllum macropodium* grown wild in Iran.

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Materials and Methods

Plant Materials

The aerial parts of *Chaerophyllum macropodum* were collected from Lonbar, Khalkhal, province of Azerbaijan, Iran, at an altitude of 1900m, in June 2000. A voucher specimen has been deposited at the Herbarium of the Research Institute of Forests and Rangelands (TARI). Tehran, Iran.

Isolation of the Essential Oil

The aerial parts of the plant were dried at room temperature and hydrodistilled for 3h using a Clevenger-type apparatus. The oil was dried over anhydrous sodium sulphate and stored 2°C in the dark. The yield based on dry weight was 0.3% (w/w).

GC Analysis: GC analysis was performed on a Shimadzu 15 A gas chromatograph equipped with a split / splitless injector (250°C) and a flame ionization detector (250°C). N₂ was used as carrier gas (1mL/min) and the capillary column used was DB-5 (50m × 0.2mm, film thickness 0.32 μm). The column temperature was kept at 60°C for 3 min and heated to 220°C with a 5°C/min rate and kept constant at 220°C for 10 min.

GC/MS Analysis: GC/MS analysis was performed using a Hewlett-Packard 5973 with a HP-5MS column (30m×0.25mm, film thickness 0.25μm). Helium was used as carrier gas at a flow rate of 1 mL/min. The column temperature was the same as the one selected for GC programming. Injector and interface temperatures were 240°C, respectively. Mass spectra were achieved at 70 eV.

Identification of the constituents of the oil was made by comparison of their mass spectra and relative retention indices (RRI) with those given in the literature and those authentic samples.^[10] Relative percentage amounts were calculated from peak area using a Shimadzu C-R4A chromatopac.

Results and Discussion

The chemical composition of the oil of *Ch. macropodum* is listed in Table I, in which the percentage and retention indices of components are given. As it is shown, about 97.0% (23 components) of the oil of *Ch. macropodum* were identified. The oil of *Ch. macropodum* consisted mainly of sixteen sesquiterpenes (52.9%), two aliphatic esters (24.3%), four monoterpenes (19.6%) and one non terpenoid compound (0.2%).

β-caryophyllene (21.0%), hexyl octanoate (12.6%) and octyl acetate (11.7%) were the major components in this oil, followed by citronellol (8.1%), α-pinene (5.4%) and clovane (5.1%).

In our previous investigation on the oil of the plant collected in around Chalous road, 120 Km North of Tehran, monoterpenes (90.2%) predominated over sesquiterpenes (6.8%), and α-pinene (23.0%), β-pinene (17.3%) and fenchyl acetate (13.8%) were the major constituents among them twenty-eight characterized, comprising (98.5%) of the total components detected in the oil.⁽¹¹⁾

Previous investigation on oils of the *Chaerophyllum* genus showed varying compositions. The dominant compound in the oil of *Ch. crinitum*, growing in Iran, was (E)-β-ocimene (50.5%).⁽¹¹⁾ The oil of *Ch. aksekiense*, growing in Turkey, contained heptacosane (10.1%), humulene epoxide II (7.8%), (E)-β-farnesene (6.2%) and caryophyllene oxide (6.0%) as major components.^[9] Essential oils of ripe fruits and umbels of *Ch. coloratum*, growing in Montenegro, contained high percentage of (E) – β – farnesene (79.2% and 68.4%, respectively).^[8]

Water distilled oil obtained from the aerial parts of *Ch. macrospermum* has the subject of our previous study. The major components were identified to be (E) – β – ocimene (40.0%), tricyclene (19.4%) and δ – 3-carene (18.3%).^[12]

Table 1- Composition of the essential oil of *Chaerophyllum Macropodium* Boiss.

Compound	Percentage ²	RRI ¹
α - pinene	939	5.4
β -pinene	980	2.9
octyl acetate	1100	11.7
trans- sabinol	1140	3.2
citronellol	1128	8.1
α – cubebene	1351	3.6
β _ bourbonene	1384	2.6
β -elemene	1391	1.4
(E)- β -damascone	1409	1.3
β -caryophyllene	1418	21.0
γ -elemene	1433	1.3
aromadendrene	1439	1.6
α -humulene	1454	1.4
clovane	1465	5.1
α -copaen-8-ol	1471	0.5
γ -muurolene	1477	0.3
germacrene-D	1480	0.8
dihydro- β -ionone	1485	0.2
δ -cadinene	1524	3.2
hexyl octanoate	1542	12.6
germacrene-B	1556	2.2
(E, Z) - farnesol	1742	2.5
β -gurjunene	1432	4.1
Total:		97%

Conclusion

The essential oil of *Chaerophyllum macropodium* aerial parts is rich in β - caryophyllene, hexyl octanoate and octyl acetate. The content of monoterpene hydrocarbons was lower than sesquiterpene hydrocarbons. In our previous investigation on the oil of the plant collected in around Chalous road, 120 Km North of Tehran, monoterpenes (90.2%) predominated over sesquiterpenes (6.8%), and α -pinene (23.0%), β -pinene (17.3%) and fenchyl acetate (13.8%) were the major constituents among them twenty- eight characterized, comprising (98.5%) of the total components detected in the oil. [11] Previous investigation on oils of the *Chaerophyllum* genus showed varying compositions. The dominant compound in the oil of *Ch. crinitum*, growing in Iran, was (E)- β -ocimene (50.5%). [11] The oil of *Ch. aksekiense*, growing in Turkey, contained heptacosane (10.1%), humulene epoxide II (7.8%). (E)- β -farnesene (6.2%) and caryophyllene oxide (6.0%) as major components. [9] Essential oils of ripe fruits and umbels of *Ch. coloratum*, growing in Montenegro, contained high percentage² of (E) – β – farnesene (79.2% and 68.4%, respectively). [8] Water distilled oil obtained from the aerial parts of *Ch. macrospermum* has the subject of our previous study. The major components were identified to be (E) – β – ocimene (40.0%), tricyclene (19.4%) and δ – 3-carene (18.3%). [12]

1- RRI: relative retention indices were calculated against n- alkanes.

2- Percentage: calculated from TIC data

knowldgment

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