VOLATILE CONSTITUENTS OF THE FRUIT OF *CORIANDRUM SATIVUM* L. FROM ISFAHAN

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ABSTRACT

The essential oil of the fruits of *Coriandrum sativum* L. which is cultivated in Isfahan was isolated by steam distillation and analyzed by TLC, GC, GC/MS and ^{1}H-NMR. Eight compounds representing 95.3% of the total components were characterized. Linalool (56.2%), γ- terpinene (12.0%) and δ-3-carene (9.7%) were the major constituents of the oil which were obtained in 0.68% (V/W) yield.

Key Words: *Coriandrum sativum*, *coriander*, *Umbelliferae*, essential oil composition, linalool, γ- terpinene

INTRODUCTION

Coriandrum sativum L. (coriander) is a culinary and medicinal plant from *Umbelliferae* family that is extensively cultivated in Iran. *Coriander* fruits have been widely used in Iranian folk medicine as carminative, spasmolytic and galactagogue. *Coriander* fruits are also used as spice and condiment in food industries (1,2).

The composition of the essential oil of *coriander* fruits in some regions of the world has been studied (3-9). Published data about volatile oil composition of *coriander* fruits obviously differ from each other, probably due to differences in the sample preparation and collection, the method of analysis, the age of fruits and geographical factors (3, 6-9). The prominent constituent of coriander oil is linalool and some references have recommended the determination of the linalool content of the coriander oil as a measure of the flavouring quality (3-9).

In ongoing evaluation of the compositional profiles and quality of Isfahanian coriander oil, the present study focused on the volatile constituents of *C. sativum* from Isfahan, Iran.

EXPERIMENTAL

Plant Materiasl: The *C. sativum* fruits were collected from plants growing in the Botanical Garden of the Faculty of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, Iran in September 1996. The Herbarium Department of Iranian Research Institute of Forests and Rangelands confirmed the plant identity as *C. sativum L.* according to the Flora Europaea (10). A voucher specimen of this plant material was deposited in the Herbarium of the Department of Pharmacognosy, Faculty of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, Iran.

Isolation and Analysis of the Oil: The riped and air-dried fruits were powdered and the volatile fraction was isolated by hydrodistillation for 3h according to the method recommended in the European Pharmacopoeia (11). The oil was dried over anhydrous sodium sulfate and stored at 4°C in the dark. The yield was 0.68% based on dried weight of sample. The oil was pale yellowish in color and was analyzed by TLC, GC, GC/MS and ^{1}H-NMR. The sample oil was identified by TLC on silica gel GF-254 precoated plates (Merck) using some pure authentic samples for comparison (linalool and β-caryophyllene). The mobile phase was benzen-ethyl acetate (98:2), and UV detection was at 254nm. Further detection was performed by anisaldehyde reagent and determination of R_f values (12,19).

GC analyses was carried out on a Varian 3400 GC with a DB-5 fused silica column (25m×0.25mm; film thickness 0.25 μm). The operating conditions were as follows: carrier gas was helium with a flow rate of 1.5 ml/min, the oven temperature was programmed 5 min isothermal at 60 °C and then from 60 to 280°C at 3°C/min, injector and detector temperatures were set at 280°C. GC/MS was run on a Finnigan MAT Incos-50 instrument and the DB-5 capillary column and the GC conditions were the same as above. Mass spectrometer conditions were as follows: ionization potential, 70 eV; ionization current, 2A; source temperature, 150°C; resolution, 1000. The identification of the constituents was based on computer matching against the library spectra of the pure substances and components of the known essential oils, MS literature data and evaluation

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of fragmentation patterns of compounds (13-18) and were confirmed by their GC retention times, as well as TLC in comparison with linalool and β-caryophyllene .

Table I. Chemical composition of the fruit oil *of Coriandrum sativum* from Isfahan

Compound	Kovat's indices (DB-5)	Method(s) of identification	%
δ-3-carene	1005	GC/MS	9.7
p-cymene	1027	GC/MS	2.1
γ-terpinene	1061	GC/MS	12.0
linalool	1102	GC/MS, TLC, ^{1}H-NMR	56.2
n-decanal	1204	GC/MS	2.2
(E)-2-tridecenal	1279	GC/MS	3.2
geranyl acetate	1382	GC/MS	4.9
β-caryophyllene	1427	GC/MS, TLC	5.0
identified compounds: 8			95.3
unidentified compounds:3			4.7

GC/MS= gas chromatography mass spectrometry; TLC= thin layer chromatography
^{1}H-NMR =Proton nuclear magnetic resonance

The percentage composition of the essential oil was computed in each case from GC peak areas without using correction factors and in comparison with *n*-decane as standard.

A series of standard hydrocarbons (C_9-C_{18}) were used to calculate Kovat's Indices from the GC analyses. Kovat's Indices were calculated by the previously published equations (16 , 22). ^{1}H-NMR of volatile oil in $CDCl_3$ was performed on a Bruker FT-NMR 80 MHz, using tetramethylsilan as internal standard.

RESULTS AND DISCUSSION

According to the TLC experiments, the R_f values of linalool and β-caryophyllene in the sample oil were respectively 0.4 and 0.9 and were similar to R_f values of pure authentic sample (19).

The GC analyses showed the presence of 11 components in the oil of which compounds representing. 95.3% of the oil were identified (Table I). Linalool (56.2%), γ-terpinene (12.0%) and δ-3 carene (9.7%) were the most prominent compounds in the essential oil of C. *sativum* from Isfahan. Other major components were β- caryophyllene (5.0%) and geranyl acetate (4.9%). The sample oil consists mainly of monoterpenoids (80.0%) of which 56.2% are oxygenated compounds and 23.8% are hydrocarbons. Low percentages of the sesquiterpenoid components (5.0%) were found in the oil. Esters and aldehydes were only 4.9% and 5.4% of the oil constituents respectively.

The presence of linalool in *coriander* was confirmed by comparing of ^{1}H-NMR spectra of *the* oil with that of linalool (14).

In contrast to results of various reported investigations (3, 5, 20) and in accord with some other reports (8, 21), no α- pinene, β-pinene, limonen, 1,8-cineole and camphor were found in the essential oil of the *coriander* fruits from Isfahan

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