COMPOSITION OF THE ESSENTIAL OIL OF *PHLOMIS OLIVIERI* BENTH. FROM NORTH OF IRAN

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ABSTRACT

The composition of hydrodistilled essential oil from aerial parts of *Phlomis olivieri* Benth. (Lamiaceae), were analyzed by GC and GC-MS. Twenty two constituents, representing 93.6% of the oil of *P. olivieri* were identified. The main compounds were germacrene D (66.1%), β- selinene (5.1%), β-caryophyllene (4.2%) and α-pinene (4.2%). A comparison of the composition of this oil with other oils of *P. olivieri* from different regions showed that germacrene D and β- caryophyllene are main compounds of all oils.

Keywords: *Phlomis olivieri*; Lamiaceae; Essential oil; Germacrene D

INTRODUCTION

The genus *Phlomis* (Lamiaceae) consists of about 100 species in the world (1). In Iran, this genus represented by 17 species (10 species are endemic) including *P. olivieri* which grows wildly in north, west and center of Iran (2). Different classes of glycosides containing diterpenoids, iridoids, phenylpropanoids, phenylethanoids and flavonoids have been identified from *Phlomis* (3, 4). Some species of *Phlomis* are used in folk medicine as stimulants, tonics, diuretics and for the treatment of ulcers and haemorrhids (3- 5). There are reports indicating various activities such as anti-inflammatory, immunosuppressive, antimutagenic, anti-nociceptive (4), antifibriel (6), free radical scavenging (7), anti-allergic (8), anti-malarial (9) and antimicrobial effects (7, 10, 11) for some species of this plant.

To the best of our knowledge, except of two reports about essential oils of *P. olivieri* (12, 13) which were collected from different regions of Iran, no work has been reported on the chemical constituents of *P. olivieri* from Guilan and this paper is the first report about the composition of the essential oil of *P. olivier* from north of Iran.

MATERIAL AND METHODS

Plant Material

Aerial parts of *Phlomis olivieri* Benth. were collected from north of Iran (Guilan or Mazandaran Province) Chaloos toward Nesa, at an altitude of 1600-1700 m in May 2003 during the flowering stages. Voucher specimen (No. 6534 TEH) has been deposited at Herbarium of Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran.

Isolation of the Oil

The fresh aerial parts of *P. olivier* (100g) were subjected to hydrodistillation using a Clevenger-type apparatus for 4 h and the oil was dried with anhydrous sodium sulphate and stored at 4-6°C.

GC and GC/MS Analysis

The analytical gas chromatography was carried out using a Thermoquest 2000 GC chromatograph with capillary column DB-1 (30 m × 0.25 mm × 0.25 μm); carrier gas, He; split ratio, 1:25, and a flame ionization detector. The column temperature was programmed at 50°C for 1 min and then heated to 265°C with a 2.5°C/min rate and then kept constant at 265°C for 20 min. GC-MS was performed on a Thermoquest 2000 with a quadrupole detector, on capillary column DB-1 (see GC); Carrier gas, He; flow rate, 1.5 ml/min and oven temperature as above. The MS operated at 70 eV ionization energy. Retention indices were calculated by using retention times of *n*-alkans that were injected after the oil at the same chromatographic conditions. The compounds were identified by comparison of retention indices (RRI) with those reported in the literature and by comparison of their mass spectra with the Wiley library (14) or with the published mass spectra (15).

RESULT AND DISCUSSION

The GC and GC-MS analysis of the essential oil of *P. olivieri* is reported in Table1. The sample gave oil in 0.1% v/w yield on a fresh weight material. The essential oil was light yellow with a distinct sharp odour. Twenty two constituents were identified from the oil of *P. olivieri*, representing 93.6% of the total oil. The major

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Table1. Composition of the essential oil of *P. olivieri* from north of Iran (Mazandaran province)

No	Components	RRI[a]	RA%[b]
1	α-Pinene	927	4.2
2	Limonene	1013	0.3
3	Z-β-Ocimene	1026	0.4
4	Linalool	1081	0.4
5	Nonanal	1082	0.6
6	Undecanal	1282	1.2
7	α-Copaene	1362	0.4
8	β-Bourbonene	1368	1.2
9	β-Elemene	1376	2.6
10	β-Caryophyllene	1398	4.2
11	α-Humulene	1433	0.4
12	E-β-Farnesene	1445	0.3
13	Dodecanol	1460	0.4
14	Germacrene D	1465	66.1
15	β-Selinene	1467	5.1
16	Bicyclogermacrene	1475	2.4
17	Germacrene A	1481	0.2
18	δ-Cadinene	1498	0.4
19	Germacrene B	1531	0.3
20	Z- Nerolidol	1540	0.6
21	Viridiflorol	1587	0.3
22	6, 10, 14-Trimethyl-2-pentadecanone	1823	1.6
Total			93.6

[a]RRI: relative retention indices as determined on a DB-1 column using the homologous series of *n*- alkanes
[b]RA: relative area (peak area relative to total peak area).

Table 2. Comparison of major components of the essential oils from aerial parts of *Phlomis olivieri* which collected from different regions of Iran

Collection Place (province)	Collection Time	Plant part	Method	Major components (percentage)
Chaloos (Guilan)	May 2003	Aerial parts (flowering stage)	Hydrodistillation	germacrene D (66.1%) β- selinene (5.1%) α- pinene (4.2%) β- caryophyllene (4.2%)
Dehbid-Semiron (Isfahan)	May 1998	Aerial parts (flowering stage)	Hydrodistillation	Hexahydrofarnesyl acetone (13.3%) spathulenol (11.4%) germacren D (9.7%) β- caryophyllene (6.9%) caryophyllene oxide (5.3%)
Damavand (Tehran)	July 2001	Aerial parts (flowering stage)	Steam distillation	germacrene D (28.1%) β- caryophyllene (16.1%) α- pinene (11.7%) β- selinene (10.2%) bicyclogrmacrene (7.4%)

compound was germacrene D (66.1%) and other compounds which were present in appreciable amounts were β- selinene (5.1%), β-caryophyllene (4.2 %) and α-pinene (4.2%). The oil contained 12 sesquiterpene hydrocarbones (83.6%), 2 oxygenated sesquiterpenes (0.9%), 3 monoterpene hydrocarbones (4.9%), 1 oxygentatd mono-terpenes (0.4 %).

The total amount of sesquiterpene fraction in the oil of *P. olivieri* (84.5 %) was higher than monoterpene ones (5.3%). Comparison of the results of the oils of *Phlomis* species showed, except of the oils of *P. herba-venti* (16), *P. lanata* (10) and *P. younghusbandii* (17), the total amount of sesquiterpene fraction was higher than monoterpene ones and germacrene D was the

most prevalent sesquiterpene which has been identified (12, 13, 18- 24).

In Table 2 the main compounds of three different oils of *P. olivieri* from Iran are shown.

Germacrene D accompanied by β-caryophyllene, as main compounds were found in all oils of *P. olivieri*. Additionally, α-pinene which was the main compound in monoterpene fraction of this oil, has been found as a major component of the other *Phlomis* which were collected from Iran, *P. olivieri* (11.7%) (13), *P. lanceolata* (8.7%) (18), *P. herba-venti* (9.4%) (16) and *P. bruguieri* (6.8%) (24). Moreover, this compound has been identified in the oils of *P. lanata* (25.4%) (10), *P. cretica* (9.4%) (23) and *P. fruticosa* (8.9%, flowers) (20), (6.6%, leaves) (21) and (12.6%, aerial part) (23) as the main component.

Comparison of the three different oils of *P. olivieri* shows that hexahydrofarnesyl acetone which is a main compound (13.3%) in Isfahan's oil (12) does not exist in other oils. In addition, caryophyllene oxide and spathulenol, two sesquiterpenes which were not detected in the oil of *P. olivieri* from Mazandaran, can be found in other samples in appreciable amounts (5.3%, 3.1% and 11.4%, 2.1%, respectively) (12, 13). The differences on chemical composition of *P. oliveri* from different regions may be due to geographical differences.

CONCLUSION

The composition of the oil of *P. olivieri* is rich in sesquiterpenes with typical major component of *Phlomis* species, namely germacrene D. According to our results, the composition of the oils of *P. olivieri* which collected from Mazandaran and Tehran showed similarities in main components.

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