

Essential Oil of *Salvia multicaulis* Vahl. Growing Wild in Paveh District (Iran)

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ABSTRACT

The genus *Salvia*, belong to the Lamiaceae family, consist of about 700 to 900 species throughout the world. Plants belonging to genus *Salvia* are pharmacologically active and have been used in folk medicine all around the world. The aim of the present study was to detect the essential oils composition of *Salvia multicaulis* Vahl. collected from Paveh, Kermanshah province. Aerial parts of plant samples were dried in shade condition and the essential oil of the plant obtained by hydrodistillation by Clevenger type apparatus was analyzed by GC/MS. Yield of essential oil was (1.5 % v/w). The results of essential oil analysis showed that among all determined compounds: bornyl acetate (19.46%), borneol (18.53%), camphor (15.21%), β -caryophyllene (5.89%), camphene (5.52%), α -pinene (5.29%), 1,8 Cineol (2.44%) were the main compounds with the greatest content.

Keywords: *Salvia multicaulis*, Essential oils, GC/MS, Paveh, Kermanshah.

INTRODUCTION

Fifty-eight species of the genus *Salvia* (Lamiaceae) are found in Iran, of which 17 are endemic (Rechinger, 1982). Some members of this genus have been widely used as herbal tea like *salvia multicalus*, *Salvia aramiensis* and flavor component as well as in folk and traditional medicine, perfumery and pharmaceutical purposes (Keller, 1978; Kamatou *et al*, 2008). Previous reports on *Salvia* species revealed that they exhibited various biological activities, such as antimicrobial, antiviral, antioxidant, cardiovascular, anticancer, anti-inflammatory, antidiabetic, spasmolytic, antiseptic and

sedative properties (Delamare *et al*, 2007; Eidi and Eidi, 2009; Hayouni *et al*, 2008; Haznedaroglu *et al*, 2001; Kamatou *et al*, 2006; Kelen and Tepe, 2008; Loizzo *et al*, 2008; Ryu *et al*, 1997).

Some of the components isolated from the extracts of *S. multicaulis* were diterpenoids, triterpenoids and norditerpenoids (Ulubelen *et al*, 1997; Ulubelen *et al*, 1998). Bagci and Kocak (2008) reported that, 1,8-cineole (17.0%), camphor (13.2%), alpha-pinene (9.3%), valeranone(8.5%) and alpha-eudesmol (5.7%) were the main components of *S. multicaulis* essential oil from Eastern Anatolian region from Turkey (Bagci and Kocak, 2008).

In another study by Tepe *et al*. (2004), α -Pinene, Eucalyptol, camphor, was reported to be the major components in *S.multicaulis* essential oil (Tepe *et al*, 2004). Therefore the results of essential oil composition in *S.multicaulis* are so different. A comparison of the chemical composition of *Salvia multicaulis* with previous published reports reveals that bornyl acetate (18.1%), b-caryophyllene (16.5%), and a-pinene (15.6%)

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were the major constituents of the flowering shoots (Ahmadi and Mirza, 1999). While the main constituents of the oil from leaves and flowers were α -pinene (26.0%), 1,8-cineol + limonene (20.0%), and camphor (19.0%) (Rustaiyan *et al.*, 1999), on the other hand, the main components of the oil from aerial parts were α -copaene (8.0%), α -pinene (6.6%), myrtenol (5.7%), and sabinyl acetate (5.3%) (Senatore *et al.*, 2004); other reports on the oil of flowering aerial parts showed that the main components were camphor (11.0%), 1,8-cineol (10.7%), borneol (8.6%), and α -pinene (7.5%) (Morteza-Semnani *et al.*, 2005)

This research aimed to investigate the composition of the essential oil extracted from *S. multicaulis* Vahl. collected from Paveh, Kermanshah province.

MATERIALS AND METHODS

The genus *Salvia*, belong to the Lamiaceae family, consist of about 700 to 900 species throughout the world. In Iran, about 58 species are present, of which some are endemic. *Salvia multicaulis* Vahl. was collected May 2011 at full flowering stage from Paveh (1530 m, 35° 3' 0"N, 46° 16' 12"E), Kermanshah province, Iran (figure 1). It was transferred to laboratory by packaging the samples in a paper pockets. The samples were dried in shade condition and at laboratory temperature. Voucher specimens were deposited in the herbarium of Research Center of Agricultural and Natural Resources of Kermanshah, Iran (number: 719). The dry plant materials (40 g) were ground into small pieces and subjected to hydrodistillation using a Clevenger-type apparatus (3h). The vial until analysis with GC obtained essential oils were dried over anhydrous sodium sulfate and stored at 4°C in a sealed brown GC-MS.

Gas Chromatography

GC analysis was carried out using a Shimadzu 15A with

DB-5 capillary column [phenyl methyl siloxane; 50 m \times 0.2 mm \times 0.32 μ m]. The oven temperature was programmed as following: 60 to 240 °C at 4 °C/min increment rate; injector temperature, 250 °C; detector temperature 260 °C; carrier gas He (1 ml/min); split ratio 1:25.

Gas Chromatography/Mass Spectrometry Analysis

GC-MS analyses were carried out applying a Hewlett-Packard 5973 with a quadrupole detector, on a HP-5 column (see GC), operating at 70 eV ionization energy, and using temperature program and carrier gas as mentioned above. Retention indices were calculated by using retention times of n-alkanes that were injected after the oil at the same chromatographic conditions. The retention indices for all components were determined according to the Van den Dool's method using n-alkanes as standard. The compounds were identified by comparison of relative retention indices (RRI, DB-5) with those reported in the literature (Adams, 2001; Chung *et al.*, 1993) and by comparison of their mass spectra with the Wiley library.

RESULTS AND DISCUSSION

Yield of essential oil in *S. multicaulis* was found (1.5 % v/w) dried herb. In this study about 38 compounds of the oil were determined. GC/MS analyses revealed that the major compounds of the oil (%) were bornyl acetate (19.46%), borneol (18.53%), camphor (15.21%), β -caryophyllene (5.89%), camphene (5.52%), α -pinene (5.29%), 1,8 Cineol (2.44%) as listed in Table (1). According to the results of this study, the main components of essential oil were bornyl acetate (19.46 %), borneol (18.53 %) and camphor (15.21 %). That it was in accordance with previous study like Ahmadi and Mirza (1999), investigation that established the bornyl acetate (18.1%) and camphor (10.0%) were among the main components of *S. multicaulis*, whereas Senatore *et*

al., (2004) also detected only in low amounts (0.4% and 0.5%, respectively) in the *S. multicaulis* Vahl. var. *simplicifolia* Boiss. Bagci and Kocak (2008) found that the main component oil from leaves and flowers of *S. multicaulis* are α -pinene (26.0%), 1,8-cineole, limonene (20.0%) and camphor (19.0%). The changes essential oil content compositions might arise from several environmental factors such as climatically, seasonal, geographical parameters and genetic differences (Shahriari *et al.*, 2013; Perry *et al.*, 1999).

CONCLUSION

Salvia multicaulis Vahl. was collected from Paveh, Kermanshah province, Iran and is utilized as the medicinal herb in Kermanshah, Iran. The essential oil of *S. multicaulis* Vahl was chemically analyzed. 38 components were found in the essential oil of *S. multicaulis* Vahl. Regarding the chemical analysis, the major compounds identified were bornyl acetate (19.46%), borneol (18.53%), camphor (15.21%), β -caryophyllene (5.89%), camphene (5.52%), α -pinene (5.29%) and 1,8 Cineol (2.44%).



Figure 1: The picture of *S. multicaulis* Vahl. collected from Paveh, Kermanshah, Iran.

Table 1. The Composition of the Essential Oil of *S. multicaulis* Vahl.

| No. | Compounds | RI | Area% |
|-----|------------------------|------|-------|
| 1 | tricyclene | 927 | 0.12 |
| 2 | α -pinene | 939 | 5.29 |
| 3 | camphene | 954 | 5.52 |
| 4 | β -pinene | 974 | 0.65 |
| 5 | myrcene | 991 | 1.54 |
| 6 | α -phellandrene | 1003 | 0.41 |
| 7 | α -terpinene | 1017 | 0.14 |
| 8 | 1,8 Cineol | 1031 | 2.44 |
| 9 | γ -terpinene | 1060 | 0.24 |
| 10 | linalool | 1097 | 0.51 |
| 11 | fenchol | 1113 | 0.11 |
| 12 | camphor | 1146 | 15.21 |
| 13 | borneol | 1169 | 18.53 |
| 14 | Terpinene-4-ol | 1177 | 0.81 |
| 15 | terpineol | 1189 | 0.51 |
| 16 | myrtenol | 1196 | 5.25 |
| 17 | geraniol | 1255 | 0.44 |
| 18 | bornyl acetate | 1289 | 19.46 |
| 19 | α -copaene | 1377 | 1.2 |
| 20 | cis – jasmone | 1392 | 0.11 |
| 21 | longifolene | 1399 | 0.15 |
| 22 | β -caryophyllene | 1419 | 5.89 |
| 23 | calarene | 1428 | 1.21 |
| 24 | aromadendrene | 1441 | 0.76 |
| 25 | α -humulene | 1452 | 0.74 |
| 26 | allo-aromadendrene | 1458 | 0.12 |
| 27 | α -amorphene | 1470 | 0.23 |
| 28 | germacrene-D | 1480 | 0.13 |
| 29 | β -seliene | 1485 | 0.13 |
| 30 | ledene | 1493 | 0.39 |
| 31 | γ -cadinene | 1513 | 0.46 |
| 32 | spathulenol | 1577 | 0.73 |
| 33 | caryophyllene oxide | 1581 | 0.89 |
| 34 | viridiflorol | 1589 | 0.13 |
| 35 | β -eudesmol | 1651 | 1.23 |
| 36 | caryophyllenol | 1668 | 0.61 |

| No. | Compounds | RI | Area% |
|----------------------|-------------|-------|-------|
| 37 | valeranone | 1675 | 0.36 |
| 38 | pentacosane | 2500 | 0.14 |
| Total Identification | | 92.79 | |

RI: Retention indexes relative to C₉-C₂₄ n-alkanes on the HP-5MS column.

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الزيوت الطيارة الضرورية في نبات (*Salvia multicaulis* Vahl.) المزروع في المناطق البرية في ايران منطقة بافيه غربي البلاد (ايران)

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ملخص

ينتمي جنس سالفيا إلى العائلة الشفوية، التي تتكون من حوالي 700-900 صنف في جميع أنحاء العالم. وتعد النباتات التي تنتمي إلى جنس السالفيا أو الميريمية منشطاً دوائياً وتستخدم في الطب الشعبي في جميع أنحاء العالم. وكان الهدف من هذه الدراسة هو الكشف عن تركيبة الزيوت الأساسية من نبات السالفيا الذي تم جمعه من منطقة بافه، مقاطعة كرمنشاه غرب ايران. و قد تم تجفيف الأجزاء الهوائية للنبات في ظروف الظل وتم تحليل الزيت العطري من المستخلص من النبات بواسطة جهاز التقطير المائي عن طريق جهاز GC/MS من نوع Clevenger. كان العائد من الزيوت الطيارة (1.5% وحدة وزن/وحدة حجم) وأظهرت نتائج تحليل الزيت العطري أن من بين جميع مركبات تم تحديد المركبات الآتية: اسيتات بورنيل (19.46%)، بورنيول (18.53%)، كامفور (15.21%)، بيتا كاريوفيلين (5.89%)، كامفين (5.52%)، الفا يانين (5.29%)، 1.8 سينيول (2.44%)، حيث كانت هذه المركبات الرئيسية هي من أكبر المكونات في الزيت الطيار.

الكلمات الدالة: *Salvia multicaulis*, GC/MS، بافيه، مقاطعة كرمنشاه.

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