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ORIGINAL ARTICLE

Chemical composition of the essential oil from Jordanian *Lupinus varius* L.

Mahmoud A. Al-Qudah *

Department of Chemistry, Faculty of Science, Yarmouk University, Irbid 21163, Jordan

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KEYWORDS

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Abstract The chemical composition of essential oil obtained by hydrodistillation from flowering shoots of *Lupinus varius* L. was analyzed by GC–FID and GC–MS. Chemical analysis of this oil showed that it includes a complex mixture of aldehydes, alcohols, esters and mono- and sesquiterpenes. Forty one compounds were characterized in the oil. The major components of the oil were 6,10,14-trimethyl-2-pentadecanone (20.5%), pentadecanal (10.2%), (E) nerolidol (8.43%), carracol ethyl ether (4.3%), α-humulene (3.6%), (2Z,13E)-ocatadeca-2,13-dien-l0-ol (3.2%) and caryophyllene-5-ol (2.7%).

1. Introduction

Lupinus is a genus of the flowering plant family Leguminosae or Fabaceae. It includes over than 200 species widely distributed in tropical and warm temperate regions of the world, with major centers of diversity located in the Mediterranean basin and South America (Dervas et al., 1999; Huyghe, 1997; Swiecicki et al., 2000). Three Lupinus species grow naturally in Jordan. These are: *Lupinus angustifolius* L., *Lupinus luteus* L. and *Lupinus varius* L. (Al-Eisawi, 1982).

L. varius L. ssp. *orientalis* Franco et Silva (= *Lupinus digitatus* Forssk, *Lupinus pilosus* L., *Lupinus hispanicus* and *Lupinus microanthus*) is an annual herb, growing in the Mediterranean, North Africa, South Europe, West Syria, and Palestine region (Tackholm, 1974; Wink et al., 1995). *L. varius* is a short to medium soft hairy annual, has the potential for use as a new cutflower crop, possessing inflorescences on the main stem and branches with blue flowers that are longer than that of some the other species of *Lupinus* (Blamey and Grey-Wilson, 1998; Burnie, 2000; Karaguzel et al., 2003). Previous studies with this species revealed the presence of several quinolizidines, as well as dipiperidine and alkaloids (Abdel-Halim et al., 1999; Mohamed and Hassanean, 1997). However, information about essential oil from the *L. varius* is unavailable.

L. varius seeds as a possible valuable source for glucomannan, which helps normalize blood sugar, relieve stress the pancreas, and discourage blood sugar abnormalities, such as hypoglycemia (Hozumi et al., 1995). In this paper we report

* Tel.: +96 277420029; fax: +96 227211117.
E-mail address: mahmoud.qudah@yu.edu.jo

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Table 1 Chemical composition (%) of the essential oil from *Lupinus varius*.

No.	Compound	KI	Area (%)
1	(2Z)-3-Pentyl-2,4-pentadien-1-ol	1070	0.65
2	Linalool	1101	0.63
3	Nonanal	1102	0.84
4	1-Methyl-1-cyclohexen-1-carboxaldehyde	1121	0.85
5	Isophorone	1128	0.73
6	Nerol	1226	0.64
7	Dihydroedulan I	1290	0.92
8	Carracol ethyl ether	1296	4.3
9	10-(Acetyl methyl)-(+)-3-carene	1387	1.2
10	Ethyl decanoate	1398	0.68
11	α-Humulene	1460	3.6
12	E-β-Ionone	1496	1.77
13	Hexadecane	1498	0.63
14	E-10-Pentadecanol	1512	0.74
15	δ-Cadinene	1530	1.64
16	Davonol acetate	1556	1.1
17	Nerolidol (E)	1561	8.43
18	Pentadeca-1,3,7,12,14-pentaen-7-ol-9-one	1568	0.90
19	Germacrene D-4-ol	1571	1.2
20	Spathulenol	1580	1.5
21	Caryophyllene oxide	1584	1.7
22	1-Bromo-2-methyldecane	1598	0.82
23	(2Z,13E)-ocatadeca-2,13-dien-l0-ol	1614	3.2
24	E-Isoeugenol acetate	1617	0.87
25	Daranol D1	1620	2.1
26	Caryophyllen-5-ol	1645	2.7
27	β-Eudesmol	1658	1.1
28	Selin-11-en-4-α-ol	1662	1.9
29	Octadecene	1679	2.3
30	Pentanoic acid,10-undecenyl ester	1686	1.3
31	Acorenone	1693	1.6
32	2-Nonadecanone	1698	1.2
33	Pentadecanal	1715	10.2
34	Ethyl octadec-9-enoate	1771	1.8
35	9-Tetradecen-1-ol acetate	1780	0.69
36	6,10,14-Trimethyl-2-penta decanone	1840	20.5
37	Hexadecanol	1847	0.79
38	Octadecane	1898	0.93
39	Methyl hexadecanoate	1914	0.62
40	Methyl 14-methylpentadecaoate	1925	2.1
41	Ethyl hexadecanoate	1992	1.2
Total			92.57

on the isolation and analysis of the volatile compounds from shoots of *L. varius* collected from the north part of Jordan.

2. Materials and methods

2.1. Plant material

Flowering shoots of *L. varius* were collected during March 2010 from populations growing wild in Irbid (Jordan). The plant was identified by Dr. Jamil N. Lahham (Department of Biological Sciences, Yarmouk University, Jordan). A voucher specimen was deposited in the herbarium of the Department of Biological Sciences at Yarmouk University.

2.2. Isolation of essential oil

The classical method of hydrodistillation using the Clevenger-type apparatus for 4 h was used for the isolation of the essential oil from shoots of *L. varius*. The essential oil was collected and stored at 4 °C until their analysis by gas chromatography/mass spectrometry (GC–MS).

2.3. GC–FID analysis

Quantitative analysis was carried out using a Hewlett Packard HP-8590 gas chromatography equipped with a split-splitless injector (split ratio, 1:50) and an FID detector. An OPTIMA-5 fused silica capillary column (30 m × 0.25 mm, 0.25 μm film thickness) was used. The oil was analyzed under linear temperature programming applied at 3 °C/min from 60 to 246 °C. Temperatures of the injector and detector (FID) were maintained at 250 and 300 °C, respectively. Concentrations (% contents) of the oil components were calculated using their relative area percentages, obtained by FID, assuming a unity response by all components.

Table 2 Components of the essential oil from *Lupinus varius*.

	Compound	No. of compounds	Area (%)
1	Oxygenated monoterpenes (%)	6	8.42
2	Sesquiterpene hydrocarbons (%)	3	7.01
3	Oxygenated sesquiterpenes (%)	11	43.83
4	Alcohol	4	5.38
5	Aldehydes (%) and ketone	5	13.99
6	Esters (%)	8	9.26
7	Alkanes (%)	4	4.68

2.4. GC–MS analysis

The chemical analysis of the essential oil was carried out using gas chromatography–mass spectrometry (GC–MS) Agillent 6890 series II-5973 mass spectrometer interfaced with a HP chemstation. The chromatographic conditions were as follow: column oven program, 60 °C (1 min, isothermal) to 246 °C (3 min, isothermal) at 3 °C/min; the injector and detector temperatures were 250 and 300 °C, respectively. Helium was the carrier gas (flow rate 0.90 mL/min). A HP-5 MS capillary column (30 m × 0.25 mm i.d., 0.25 μm film thicknesses) was utilized. The actual temperatures in MS source reached approximately 180 °C. The ionization voltage was 70 eV. A hydrocarbon mixture of *n*-alkanes (C8-C20) was analyzed separately by GC/MS under same chromatographic conditions using the same HP-5 column.

2.5. Component identification

The components of the hydrodistilled essential oil obtained from fresh plant was identified using built in libraries (Nist Co and Wiley Co, USA) and by comparison of their calculated retention indices relative to (C8-C20) *n*-alkanes with literature values measured with columns of identical polarity or with authentic samples (Adams, 2004; Budzikiewicz et al., 1964; McLafferty, 1962). Linalool, hexdecane, δ-cadinene, α-humulene, octadecane, β-eudesmol, (Fluka, Buchs, Switzerland) was used as reference substances in GC/MS analysis. GC-grade *n*-hexane and analytical reagent grade anhydrous sodium sulphate (Na_2SO_4) were used.

3. Results

By hydrodistillation, shots of *Lupinus varius* L. yielded 0.4% (V/W) of a colorless essential oil with a characteristic odor. The results obtained by GC–MS analysis of the oil are presented in Table 1. Forty one components were identified in shoots of *Lupinus varius* L. The main component of the essential oil was 6,10,14-trimethyl-2-pentadecanone (20.5%). The other characteristic compounds determined were: pentadecanal (10.2%), (E) nerolidol (8.43%), carracol ethyl ether (4.3%), α-humulene (3.6%), (2Z, 13E)-ocatadeca-2, 13-dienl0-ol (3.2%) and caryophyllene-5-ol (2.7%). The main compounds of the oil were chemically classified as follows: esters (9.26%), alcohols (5.38%), alkane (4.68%), oxygenated monoterpenes (8.42%), sesquiterpene hydrocarbons (7.01%), and oxygenated sesquiterpenes (43.83%) (Table 2).

4. Conclusion

This is the first report to study the volatile components of essential oil from *L. varius* L. This study revealed that the oxygenated sesquiterpenes are major components of essential oil from *L. varius* L. and that is similar to that found in members of the Leguminosae family in previous reports (Alicia et al., 1998; Alessandra et al., 2004; Fethia et al., 2006).

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