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Research Paper

Essential Oil Composition from *Juniperus communis* Originated from Albania

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Abstract: The essential oil of juniper berries (*Juniperus communis* L., Cupressaceae) is traditionally used for medicinal and flavoring purposes. The aim of the present study was to contribute to the knowledge of the essential-oil composition of *J. communis*, which was performed by capillary GC-MS with an HP-5 column and with an EI detector. Identification of the compounds was made by comparison of mass spectra and retention indices with literature records *J. communis* L. is composed mainly of monoterpene (71.8%) and sesquiterpene hydrocarbons (18.7%). Totally were identified (98.2%) of the chemical constituents amounting to 56 compounds and the principalwere: α-pinene (35.8%), β-myrcene (19.9%), sabinene (10.0%) and germacene D (4.5%).

***Keywords**: Essential oil, α-pinene, GC-MS, Juniperus communis.*

Introduction

Medicinal plants present a rich source of new biologically active compounds. Especially popular today is the concept of food that combines nutritional and medicinal benefits. Essential oils (EOs) from aromatic and medicinal plants receive particular attention as potential natural agents with a wide spectrum of biological activities. EOs are proven to have various pharmacological effects, such as: spasmolytic, carminative, hepatoprotective, antiviral, and anticarcinogenic effects (Bowles, 2004; Lahlou, 2004).

The various applications of essential oils account for the great interest in their study. Such applications may be found in the cosmetic industry, as ingredients of fragrances, decorative cosmetic, fine fragrances and flavouring, in the food industry, as aromas and flavours, in the pharmaceutical industry, as active components of medicines and as antibacterials/antimicrobials, and in aromatherapy.

At present, there are many studies in which they are used as intermediaries in fine chemistry reactions, among other applications (Zygadlo and Juliani 2000).As consumers are avoiding the consumption of products with synthetic additives or preservatives, the natural products constitute an alternative, mainly because they are considered safe, natural and biodegradable, with low toxicity to mammals.

J. communis L. (Cupressaceae) is a natural evergreen shrub or tree growing in dry matorral shrublands and woodlands regions of Asia, Europe, North Africa and North America. For its diuretic, antiseptic and gastrointestinal properties (Stanić *et al.,* 1998) *J. communis* L. has been known as medicinal plant for centuries. Juniper oil is a natural product which is used in the pharmaceutical and food industries and perfumery, as well as in cosmetics. Certain spirits (gin) are made by distillation from fermented juniper berries (Morton *et al.,* 1986, Maarse *et al.,* 1991).

Material and Methods

Essential oil: was purchased as an Albanian commercial sample.

Gas Chromatography-Mass Spectrometry: essential oil analyseswas performed on a Shimadzu GC-2010-GCMS-QP2010 system operating at 70eV. This was equipped with a split/splitless injector (230^{o}C) and a fused silica HP-5 MS capillary column (30 m x 0.25 mm i.d., film thickness 0.25 μm). The temperature program was from 50 ^{o}C to 290 ^{o}C, at a rate of 4 ^{o}C/min. Helium was used as a

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carrier gas at a flow rate of 1.0 ml/min. Injection volume of each sample was 1.0 µl. Arithmetic indices for all compounds were determined according to Van den Dool and Kratz 1963, using n-alkanes as standards. The identification of the components was based on comparison of their mass spectra with those of NIST21 and NIST107(Massada, 1976), and by comparison of their retention indices with literature data (Adams, 2007). Essential oilwas often subjected to co-chromatography with authentic compounds (Fluka, Sigma).

Figure 1. *J. communis* (photo L. Shuka)

Results and Disccussion

J. communis L. is composed mainly of monoterpene 71.8% and sesquiterpene hydrocarbons (18.7%). Totally were identified (98.2%) of the chemical constituents amounting to 56 compounds and the principal were: α-pinene (35.8%), β-myrcene (19.9%), sabinene (10.0%) and germacene D (4.5%). Our results are in agreement with samples from Greece (Chatzopoulou & Katsiotis, 2006), Serbia (Matović *et al.*, 2011), Bulgaria (Höferl *et al.*, 2014) and Kosovo (Harizi *et al*., 2013) with major components being α-pinene (27-51.4%), β-myrcene (8.3-14.1%) and sabinene (5.8-13.3%). While in 2014, Salamon and colleagues reported the chemical composition of common Juniper EO from 16 Albanian localities resulting in three main chemotype groups. The first group has the dominant compounds β-myrcene (44.5 ± 3.04 %) and α-pinene (19.6 ± 3.35 %). The second type is characterised by the contents: α-pinene (25.1 ± 1.78 %), β-pinene (13.4 ± 4.41 %) and β- myrcene (21.2 ± 4.79 %) and the third: α-pinene (31.6 ± 1.81 %), β-pinene (13.6 ± 1.78 %) and β-myrcene (18.5 ± 5.60 %). The last has very high content of α-pinene (37.7 ± 1.92 %), β-pinene (12.4 ± 2.22 %) and β-myrcene (18.6 ± 3.65 %) (Salamon *et al.*, 2014). Our results are in agreement with the third group reporting the *J. communis* EO as a α-pinene chemotype. The results obtained by chemical analysis of wild *Juniperus communis* L. EO is presented in Table 1.

Table 1. Composition of the commercial essential oils of *J. communis* (JC)

Compounds [a]	AI [b]	JC(%)	ID [c]
Tricyclene	919	tr	AI, MS
α-Thujene	926	0.1	AI, MS
α-Pinene	931	**35.8**	AI, MS, Co-GC
Camphene	945	0.3	AI, MS
Thuja-2,4(10)-diene	952	tr	AI, MS
Sabinene	972	**10.0**	AI, MS
β-Myrcene	992	**19.9**	AI, MS, Co-GC
α-Phellandrene	1003	0.1	AI, MS
δ-3-Carene	1015	0.5	AI, MS, Co-GC
p-Cymene	1024	0.7	AI, MS, Co-GC
Limonene	1027	3.5	AI, MS
γ-Terpinene	1059	1.0	AI, MS, Co-GC

Terpinolene	1087	1.0	AI, MS
Linalool	1101	0.1	AI, MS, Co-GC
α-Campholenal	1126	tr	AI, MS
trans-Pinocarveol	1138	tr	AI, MS
Borneol	1164	tr	AI, MS, Co-GC
Terpinene-4-ol	1176	2.2	AI, MS, Co-GC
p-Cymen-8-ol	1187	0.1	AI, MS
α-Terpineol	1191	0.3	AI, MS
Citronellol	1232	tr	AI, MS
Bornyl acetate	1286	0.3	AI, MS, Co-GC
Undecanone	1297	tr	AI, MS
α-Cubebene	1349	0.7	AI, MS
Citronellyl acetate	1357	tr	AI, MS
α-Ylangene	1371	tr	AI, MS
α-Copaene	1375	0.9	AI, MS
β-Elemene	1392	1.5	AI, MS
Sibirene	1401	0.2	AI, MS
β-Caryophyllene	1419	2.0	AI, MS, Co-GC
β-Copaene	1428	0.1	AI, MS
γ-Elemene	1434	0.5	AI, MS
Aromadendrene	1438	tr	AI, MS
Cis-Muurola-3,5-diene	1450	tr	AI, MS
α-Carryophyllene	1453	1.7	AI, MS, Co-GC
(E)-β-Farnesene	1458	0.8	AI, MS
cis-Muurola-4(14),5-diene	1463	tr	AI, MS
trans-Cadina-1 (6), 4-diene	1473	0.1	AI, MS
γ-Muurolene	1477	1.0	AI, MS
Germacrene D	1481	**4.5**	AI, MS
β-Selinene	1486	0.4	AI, MS
trans-Muurola-4(14),5-diene	1492	0.1	AI, MS
Viridiflorene	1495	0.9	AI, MS
α-Muurolene	1500	0.7	AI, MS
δ-Amorphene	1510	0.1	AI, MS
γ-Cadinene	1514	1.0	AI, MS
δ-Cadinene	1524	2.9	AI, MS
α-Cadinene	1538	0.2	AI, MS
Selina-3,7(11)-diene	1541	0.2	AI, MS
Germacrene B	1557	1.3	AI, MS
Spathulenol	1578	0.1	AI, MS
Humulene epoxide II	1610	tr	AI, MS
1-epi-Cubenol	1629	tr	AI, MS
α-Muurolol (Torreyol)	1643	0.1	AI, MS
Cubenol	1648	t	AI, MS
α-Cadinol	1656	0.1	AI, MS
Total (%)		**98.2**	
Monoterpene Hydrocarbons		71.8	
Oxygenated Monoterpenes		3.8	
Sesquiterpene Hydrocarbons		18.7	
Oxygenated Sesquiterpenes		0.3	

[a]Compounds listed in order of elution from an HP-5 MS capillary column; [b] AI: Arithmetic indices as determined on a HP-5 MS capillary column using a homologous series of n-alkanes (C9-C23); [c] Identification method: AI=Arithmetic Index, MS=mass spectrum, Co-GC=Coinjection with authentic compound. Concentrations below 0.05% are marked as tr (traces).

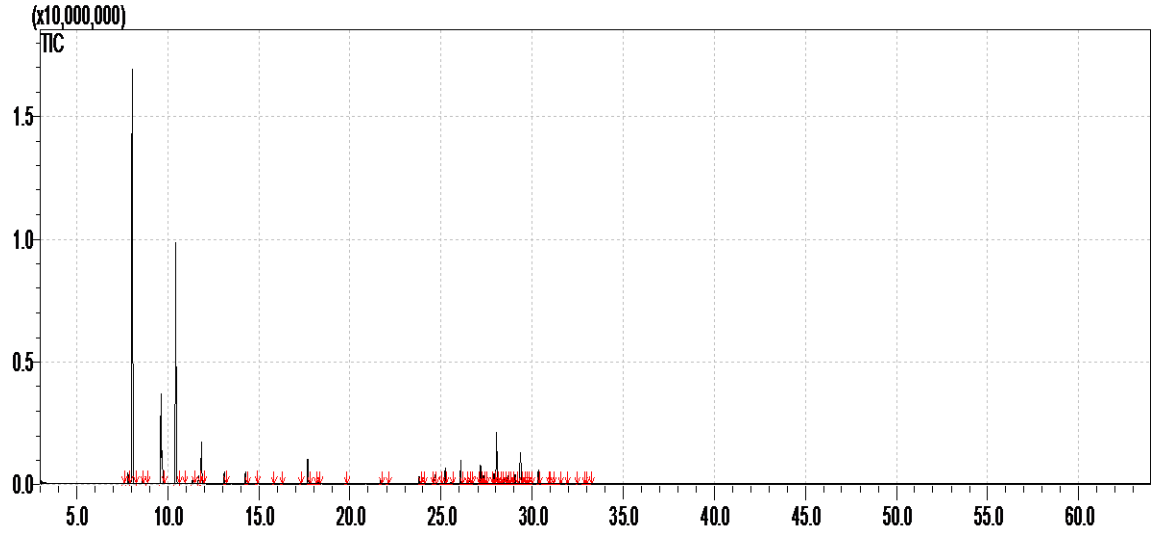

Figure 2. GC-MS chromatogram of *J. communis* EO

Conclusions

The chemical composition determines its potential for food additive production, an efficient way to improve people's health and quality of life. Furthermore, it expands its areas of application to perfumery, cosmetics, pharmacy and medicine. *J. communis*, therefore, is considered as significant economic potential in Albania.

J. communis is included in the red list of Albania (VU A1b), we highly recommend more effort to introduce and practice the cultivation of this valuable medicinal and aromatic plant.

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