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Composition of needle oil of *Juniperus communis* L. from north India

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ABSTRACT

GC and GC-MS analyses of volatile oil of needle of *Juniperus communis* L. from north Indian plains showed presence of forty one components accounting 94% of the oil. The major constituent was sabinene (27.5%), followed by elemol (15.8), limonene (13.9), bornyl acetate (7.2), myrcene (5.3) and α-pinene (4.0).

INTRODUCTION

Juniperus communis L. belongs to family cupressaceae and known as 'common juniper'. It is a procumbent dense shrub, rarely a small tree found in the Himalayas. The fruits have a gin-like aroma and sweet terebinthinate taste. Fruits are used in Europe for the preparation of alcoholic beverages. The fruits and their volatile oils are carminative, stimulant, diuretic and useful in drops especially in conjunct with drugs (Anon. 1959). They have been used in disorders of genital tract as gonorrhea, gleet, leucorrhea and in cutaneous diseases. All parts of plant produce essential oils on extraction with solvents or by distillation and have different chemical compositions. A survey of literature indicated that the leaf oil of *J.communis* contains α-pinene, camphene and cadinene as major constituents (Gildemeister & Hoffmann, 1956). Rudolff & Sood (1969) reported α-pinene, myrcene as major constituents in the leaf volatile oil from Canadian origin. Banthorpe *et al.* (1973) determined the composition of leaf oils of different species of *J. communis* and found α-pinene, β-pinene, myrcene and limonene. Horster (1973) compared the chemical composition of four samples of needle oils and reported α-pinene, myrcene, 1,4-cineole, camphene, α-phellandrene, as major constituents. In 1974, Horster *et al* identified the chemical components of Romanian needle oil as α-pinene, sabinene, 1,4-cineole, myrcene, terpinen-4-ol, p-cymene and β-phellandrene. Tanker and Sarer (1975) reported α-pinene, sabinene, β-pinene, myrcene and γ-terpinene as major constituents. Svendsen et al (1985)

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compared the chemical composition of juniper needle oil produced in Norway from shrubs harvested in lowland with shrubs in highlands and found high content of α-pinene in the former and sabinene in the latter. Laakso et al. (1987) examined juniper leaf oil from different locations in Finland and found upto 93% of α-pinene. Vernin et al (1988) analyzed juniper needle oil from Sainte Baum Massif (near Marseilles) and found sabinene as a major component. Vernin et al (1990) also examined the sesquiterpenoids fraction of juniper needle oil from Marseilles and found cadinene (11.0%), *t*-cadinol (9.5), E-β-elemene (8.9), α-terpineol (7.4) α-cadinol (6.7), spathulenol (6.3) as major constituents. In 1989, Bats *et al* undertook the chemical composition of juniper branch oil and found thujopsene, α-pinene, sabinene as main components. In 1988, Gelsomini *et al* reported that the amount of oxygenated constituents of juniper leaf oil was much less than that found in berry oil. Proenca and Rodrigues (1989) reported α-pinene, δ-cadinene, limonene, myrcene, β-caryophyllene, germacrene D as major constituents. Looman & Svendsen (1992) found that the average ratio for α-pinene: sabinene:limonene was 21:45:5 in Norway oil. In the present communication we reported chemical composition of juniper needle oil and found quite different results as compared to other reports.

MATERIALS AND METHODS

Plant material

The fresh needles of male *J.communis* were collected from botanical garden of D.D.U. Gorakhpur University, in July 2001. A voucher specimen was deposited at the Herbarium of Science Faculty.

Isolation of oil

The needles were cleaned, washed, cut into small pieces and hydrodistilled in a Clevenger's apparatus. The oil was dried over anhydrous sodium sulphate (yield 0.58mL/kg) and stored at 4°C.

Chemical investigation

The gas chromatogram of the oil was obtained using a Hewlett Packward 5890 Series II equipped with a flame ionization detector and a HP-5 fused silica column (length 30 m, 0.32mm i.d. and film thickness 0.25μm),whose injector and FID temperature were maintained at 250° and 270°C respectively. The amount of sample injected was 0.1μl (in split ratio 95:1) and the flow rate was fixed at 1.1 mL/min. Nitrogen was used as a carrier gas and the oven temperature was programmed as follows: 75°C held for 1 min., rising at 1.5°C/min to 185°C held for 1 min, then at 9°C/min to 275°C and held for 2 min.

GC-MS analysis of the oil was undertaken using a Hewlett Packard 6890 series GC fitted with a Hewlett Packard 5973 mass detector and a HP-5 GC column 30m length, 0.25mm i.d. and film thickness 0.25 μm (crosslinked with 5% phenyl methyl siloxane). The injector, GC-MS interface, ion source and selected mass detector temperatures were maintained at 250°, 280°, 230°, and 150°C respectively. Helium was used as a carrier gas and flow rate was taken as 1.0 mL/min in a split mode (80:1). The oven temperature was programmed as follows: 75°C held for 1 min., rising at 1.5°C/min to 185°C held for 1 min, then at 9°C/min to 275°C and held for 2 min.

Identification of components

The percentage of components was taken from capillary GC traces with FID wherever available or directly from the GC-MS percentage of total ion current peak. Chemical constituents were identified by comparing their mass spectra with the library NBS 75 K and/or by co-injection with authentic samples (Table 1.)

Table 1 : Composition of *Juniperus communis* needle essential oil from north Indian plains

Compound	%	Retention Index	Compound	%	Retention Index
cis-3-hexenol	0.24	0857	**terpinen-4-ol**	**2.52**	1177
α-thujene	1.12	0931	α-terpineol	0.10	1189
α-pinene	**4.02**	0941	**bornyl acetate**	**7.22**	1287
camphene	0.37	0953	β-bourbonene	0.05	1384
sabinene	**27.45**	0975	β-elemene	0.09	1391
β-pinene	0.40	0980	β-caryophyllene	0.15	1420
myrcene	**5.27**	0993	α-humulene	0.05	1458
α-phellandrene	Traces	1007	germacrene D	1.53	1482
α-terpinene	0.78	1020	α-muurolene	0.15	1499
p-cymene	0.15	1026	α-amorphene	0.17	1506
limonene	**13.90**	1031	δ-cadinene	0.76	1524
(Z)-β-ocimene	Traces	1040	**elemol**	**15.81**	1550
(E)-β-ocimene	0.06	1050	trans-nerolidol	0.08	1566
γ-terpinene	1.45	1064	germacrene D-4-ol	0.43	1574
cis-sabinene hydrate	0.37	1071	oplopenone	0.40	1608
terpinolene	1.00	1090	10-*epi*-γ-eudesmol	0.20	1620
trans-sabinene hydrate	0.34	1099	γ-eudesmol	1.91	1630
cis-p-menth-2-en-1-ol	0.18	1121	β-eudesmol	1.93	1649
1-terpineol	0.10	1134	α-eudesmol	1.80	1652
camphor	0.05	1144	α-cadinol	1.01	1653
borneol	0.10	1167			

RESULTS AND DISCUSSION

The chemical composition of needles volatile oil of *J. communis* L. done by GC and GC-MS revealed the presence of forty one components accounting 94% of the total oil. The major constituent was sabinene (27.5) followed by elemol (15.8), limonene (13.9), bornyl acetate (7.2), myrcene (5.3%), α-pinene (4.0) and terpinen-4-ol (2.5). The comparative data (Table 2.) indicate considerable differences in the composition of various samples of juniper oil. This seems to be due to the geographical, pedogenetical and environmental variations during cultivation of plant within various samples. It may be concluded that juniper needle oil obtained from Gorakhpur is rich in sabinene and elemol. The presence of high contents of elemol and eudesmol (α, β and γ-isomers) in our sample is quite interesting.

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Table 2. Composition (in%) of *J. communis* essential oils obtained from different origins

α-thujene	α-pinene	sabinene	β-pinene	myrcene	limonene	γ-terpinene	terpinen-4-ol	bornyl acetate	germacrene-D	Plant part	Reference
1.12	4.02	27.45	0.40	5.27	13.90	1.45	2.52	7.22	1.53	Needle	Present findings
-	74-83	0.1-0.3	4.2-5.2	3-4	0.9-1.2	Tr	0.1-0.2	0.5-0.2	-	Leaf	Rudolff & Sood, 1969
-	82.0	-	3.0	3.0	2.0	-	-	-	-	Leaf 1	Banthorpe *et al*, 1973
-	93.0	-	-	1.0	2.0	-	-	-	-	Leaf 2	Banthorpe *et al*, 1973
-	92.0	-	2.0	-	-	-	-	-	-	Leaf 3	Banthorpe *et al*, 1973
-	89.0	-	1.0	2.0	-	-	-	-	-	Leaf 4	Banthorpe *et al*, 1973
-	13-81	0.5-44.6	0.0-1.9	2.9-4.5	-	-	1.0-4.4	0-0.2	-	Needle	Horster, 1973
-	33.7	27.6	1.1	5.5	-	3.0	4.6	0.4	-	Leaf	Horster *et al*, 1974
1.8	29.6	30.5	3.7	4.3	8.5	2.7	-	-	-	Leaf	Tanker & Sarer, 1975
-	47-71	0.2-8.0	-	-	4-20	-	-	-	-	Needle 5	Svendsen *et al*, 1985
-	10-28	29-48	-	-	3-10	-	-	-	-	Needle 6	Svendsen *et al*, 1985
-	23-93	0.2-60	0.9-2.9	2.0-10.7	0.5-17.6	Tr	Tr	-	Tr	Leaf	Laakso *et al*, 1987
-	16.5	48.4	0.9	3.5	2.0	1.2	-	-	Tr	Needle	Vernin *et al*, 1988
1.3	18.7	5.0	1.2	1.8	2.0	1.8	2.0	0.12	0.7	Branch	Bats *et al*, 1989
-	20	1.7	1.1	8.5	8.7	0.2	0.6	-	7.0	Leaf	Proenca & Rodrigues, 1989
-	46	8.6	2.9	17.7	8.7	3.2	-	-	-	Alcoholic ext. of berry	Taskinen & Nykanen, 1976

1. *J. communis*, **2**. *J.communis* ssp. *Nana* Syme, **3**. *J.communis* ssp. *Hibemica* Gord, **4**. *J.communis* ssp. *Prostrata* Beissn, **5**. lowlands, **6**. highlands
Tr< 0.1

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