

Essential Oil Composition of *Aralia cachemirica* from Uttarakhand, India

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Abstract: The essential oils obtained from leaves and roots of *Aralia cachemirica* were analyzed by capillary GC and GC-MS. A total of 25 constituents, representing 9.14 % in leaf essential oil and 26 components, representing 96.5% in root essential oil were identified. Both leaf and root oils were characterized by the presence of α -pinene (41.0%, 52.7%) and β -pinene (35.1%, 13.6%) as the major constituents. Other constituents identified in significant amount were β -caryophyllene, terpinen-4-ol, myrtenol and borneol.

Keywords: *Aralia cachemirica*; essential oil; GC-MS; α -pinene; β -pinene.

1. Introduction

The Genus *Aralia* L. (Araliaceae) is represented by more than 50 species in world distributed in N. America, E. Asia, China and Indo-Malaya [1]. In India, the genus is represented by 11 species [2]. *Aralia cachemirica* Decne. is a perennial aromatic herb distributed from Afghanistan to South East Tibet. In India, it is mainly occurred in Jammu & Kashmir, Himachal Pradesh and Uttarakhand [3]. The plant is 1.5-3.0m long with 2-3 pinnate leaves and usually large ovate long-pointed, toothed leaflets, and with many yellowish-green umbels in a branched cylindrical cluster to 30 cm. The genus *Aralia* has been subject to chemical and pharmacological studies due to their use in traditional medicine to treat gastritis, rheumatic arthritis, inflammation, nephritis and diabetes mellitus [4-9]. The anticancer activity has also been reported in this genus [10].

A review of literature revealed that the antibacterial and hypoglycemic activities of *A. cachemirica* have been explored [11- 12]. Chemical composition has also been investigated once from Jammu & Kashmir [13]; but, there were no report on chemical composition from Uttarakhand region. Therefore, the aim of the present investigation was to study the essential oil composition of leaf and root of *A. cachemirica* from Kumaon region of Uttarakhand, India.

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2. Materials and Methods

2.1. Plant Material

The fresh leaves and roots of *A. cachemirica* were obtained from experimental garden (Sampda) of Central Institute of Medicinal and Aromatic Plants (CIMAP), Research Centre, Purara, Uttarakhand, India in September. The plant was authenticated by botany department of the centre (CIMPUR 219). The site is located between the coordinates 28° 60' to 31° 29' N, 77° 49' to 80° 60' E and at a height of 1250 m in Kattyur valley. Climatologically, the site falls in temperate zone (1200-1700 m) of western Himalaya, with the monsoon usually breaking in June and continuing up to September. The fresh leaves and roots (200g each) were subjected to hydro-distillation using Clevenger-type apparatus for 3 hours. The oil yields in leaves and roots were 0.20% and 0.15%, respectively. The oils were dried over anhydrous Na₂SO₄ and stored in sealed vials under refrigeration prior to analysis.

2.2 Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GC-MS)

GC analyses of the oil samples was carried out on a Perkin-Elmer Auto XL GC and Nucon gas chromatograph model 5765 equipped with FID and two different stationary phases, PE-5 (50 m x 0.32 mm; 0.25 µm film coating) and BP-20 (coated with a Carbowax 20M, 30 m x 0.25 mm x 0.25 µm film thickness) fused silica capillary columns, respectively. Hydrogen was the carrier gas at 1.0 ml/min. Temperature programming was done from 100°C - 280°C at a rate of 3°C/min (for PE-5) and from 70°C - 230°C at a rate of 4°C/min (for BP-20). The injector and detector temperatures were 220°C and 300°C on PE-5 and 200°C and 230°C on BP-20 columns, respectively. The injection volume was 0.02 µL neat and Split ratio was 1: 30. GC-MS was done on Perkin-Elmer AutoSystem XL GC interfaced with a Turbomass Quadrupole mass spectrometer fitted with a PE-5 fused silica capillary column (50 m x 0.32 mm i.d., film thickness 0.25 µm). The oven temperature ranged from 100-280°C, programmed at a rate of 3 °C/min, using He as carrier gas at 10 psi constant pressure, a split ratio of 1:30, injector, transfer line and source temperatures were 250 °C; ionization energy 70 eV; mass scan range 40-450 amu. Identification of constituents were done on the basis of Retention Index (RI, determined with reference to homologous series of *n*-alkanes (C₉-C₂₄, Polyscience Corp., Niles IL) under identical experimental condition), co injection with standards (Sigma and standard isolates), MS Library search (NIST and WILEY), by comparing with the MS literature data [14-15]. The relative amounts of individual components were calculated based on GC integrator peak areas without using correction factors.

3. Results and Discussion

The essential oil yield and composition of leaf and roots of *A. cachemirica* is summarized in Table 1. The essential oil yield was 0.20% and 0.15% in leaf and roots, respectively. GC and GC-MS analysis afforded the identification of 25 constituents representing 91.4% in leaf essential oil and 26 representing 96.5% in root oil. Both the essential oils were dominated by monoterpene hydrocarbons (81.0% and 67.8% in leaf and root, respectively). α -Pinene (41.0%, 52.7%) and β -pinene (35.1%, 13.6%) were the most abundant constituents identified in both leaf and root oil, respectively. Oxygenated monoterpenes were the second major portion of these two oils. The main oxygenated monoterpenes of leaf oil were myrtenol (2.0%), borneol (1.6%), 1,8 cineole (1.2%) and terpinen-4-ol (1.0%), while of root oil terpinen-4-ol (5.1%), borneol (3.0%), myrtenol (2.6%), verbenone (1.6%), camphor (1.5%), α -campholenal (1.1%) and (*Z*)-piperitol (1.0%). On the other hand, sesquiterpene hydrocarbons were observed to be higher in root oil (6.8%) compared to leaf oil (0.5%) and this class of terpenes was mainly represented by β -caryophyllene in both the oils. Although the leaf and root oils

have uniform qualitative composition; but both differ quantitatively. The leaf oil contained almost similar amount of α -pinene and β -pinene, whereas root oil possessed α -pinene in higher percentage than β -pinene.

The essential oil composition of shoot and root oil of *A. cachemirica* grown in Gulmarg (Jammu & Kashmir) has been investigated earlier [13]. However, in present study 14 components were identified for the first time which was not reported in previous study. Shoot and root oils of *A. cachemirica* in earlier study contained α -pinene and β -pinene as chief constituents. Interestingly, α -pinene content was higher in Gulmarg oils as compared to present oils. However, percentage of β -pinene was almost similar in both places. It indicated that α -pinene is significantly affected by climatic conditions in *A. cachemirica*.

Table 1. Essential oil composition of *Aralia cachemirica* leaf and root from India

No	Compounds	RI ^a	RI ^b	Peak Area (%)			
				LO	RO	SO ^[13]	RO ^[13]
1.	α -Thujene	927	1026	0.4	-	-	0.2
2.	α -Pinene	934	1023	41.0	52.7	52.5	73.7
3.	Camphene	949	1063	0.8	t	0.6	0.4
4.	Sabinene	973	1116	1.6	t	-	0.8
5.	β -Pinene	977	1104	35.1	13.6	35.5	13.4
6.	Myrcene	989	1158	1.8	t	4.1	1.1
7.	α -Phellandrene	1009	1160	t	0.9	-	0.1
8.	α -Terpinene	1016	1176	0.1	t	-	-
9.	Limonene	1028	1195	0.2	0.5	2.7	1.0
10.	1,8-Cineole	1031	1199	1.2	0.8	-	-
11.	(Z)- β -Ocimene	1038	1228	-	t	0.6	t
12.	Linalool	1099	1535	0.5	-	-	-
13.	α -Campholenal	1125	1482	0.7	1.1	0.1	0.3
14.	Camphor	1143	1512	0.2	1.5	0.1	0.1
15.	Borneol	1164	1692	1.6	3.0	-	3.2
16.	Terpinen-4-ol	1177	1591	1.0	5.1	0.5	0.3
17.	(Z)-Piperitol	1190	1758	-	1.0	-	-
18.	Myrtenol	1201	1785	2.0	2.6	-	-
19.	Verbenone	1208	1709	0.4	1.6	-	-
20.	<i>p</i> -Cymen-9-ol [†]	1300	-	0.2	t	-	-
21.	β -Caryophyllene	1419	1585	0.5	5.5	-	-
22.	α -Humulene	1454	1674	-	1.3	-	-
23.	Germacrene-D-4 β -ol	1575	2069	0.1	t	-	-
24.	Spathulenol	1578	2143	0.3	t	-	-
25.	Caryophyllene oxide	1584	1989	0.3	1.3	0.1	0.2
26.	β -Eudesmol	1652	2226	0.8	1.4	-	-
27.	Tretinon [†]	-	-	0.2	1.4	-	-
28.	Hexatriacontane	-	-	0.3	1.2	-	-
<i>Class composition</i>							
Monoterpene hydrocarbons				81.0	67.7		
Oxygenated monoterpenes				7.8	16.7		
Sesquiterpene hydrocarbons				0.5	6.8		
Oxygenated sesquiterpenes				1.5	2.7		
Others				0.5	2.6		
Total identified				91.3	96.5		
Oil content (%)				0.20	0.15	0.12	0.42

RI^a on PE-5 column (relative to *n*-alkane); RI^b on BP-20 column; MS: (GC-MS), t: trace (<0.1%); LO: Leaf oil; RO: Root oil; SO: Shoot oil; [†] tentatively identified [13].

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