

Date : March 16, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP03


Customer identification : Cedarwood Virginia - USA - 211267-20

Type : Essential oil

Source : *Juniperus virginiana*

Customer : Fern & Petal

ANALYSIS

Method: PC-MAT-014  - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Sylvain Mercier, M. Sc., Chimiste

Analysis date : March 15, 2021

Checked and approved by :

Alexis St-Gelais, M. Sc., chimiste 2013-174

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow viscous liquid

Refractive index: 1.5054 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Class
α -Pinene	0.06	Monoterpene
α -Fenchene	0.01	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
α -Methylstyrene	0.01	Normonoterpene
Δ^3 -Carene	0.01	Monoterpene
para-Cymene	0.01	Monoterpene
Limonene	0.01	Monoterpene
Terpinolene	0.01	Monoterpene
<i>trans</i> -Pinocarveol	0.01	Monoterpenic alcohol
Citronellal	0.01	Monoterpenic aldehyde
Borneol	tr	Monoterpenic alcohol
Terpinen-4-ol	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
α -Terpineol	0.02	Monoterpenic alcohol
Verbenone	0.02	Monoterpenic ketone
Carvacrol methyl ether	0.04	Monoterpenic ether
Bornyl acetate	tr	Monoterpenic ester
Brasila-1,10-diene	0.04	Sesquiterpene
Carvacrol	0.02	Monoterpenic alcohol
α -Terpinyl acetate	0.09	Monoterpenic ester
African-1-ene	0.02	Sesquiterpene
Cyclosativene I	0.01	Sesquiterpene
Cyclosativene II	0.01	Sesquiterpene
2-epi- α -Funebrene	0.52	Sesquiterpene
α -Duprezianene	0.72	Sesquiterpene
Isolongifolene	0.05	Sesquiterpene
β -Elemene	0.72	Sesquiterpene
Unknown	0.18	Sesquiterpene
α -Chamipinene	0.08	Sesquiterpene
α -Cedrene	20.09	Sesquiterpene
β -Funebrene	2.16	Sesquiterpene
β -Caryophyllene	0.36	Sesquiterpene
β -Cedrene	4.40	Sesquiterpene
β -Duprezianene	0.14	Sesquiterpene
<i>cis</i> -Thujopsene	22.93	Sesquiterpene
(<i>Z</i>)- β -Farnesene?	0.08	Sesquiterpene
Isobazzanene	0.22	Sesquiterpene
Isobarbatene	0.13	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.19	Sesquiterpene
β -Barbatene	0.07	Sesquiterpene
Prezizaene	0.21	Sesquiterpene
α -Himachalene	0.22	Sesquiterpene
7,8-Dehydro- α -acoradiene?	0.19	Sesquiterpene
Cadina-4,11-diene	0.05	Sesquiterpene
α -Humulene	0.05	Sesquiterpene

α-Acoradiene	0.35	Sesquiterpene
β-Acoradiene	0.22	Sesquiterpene
(E)-β-Farnesene	0.04	Sesquiterpene
Thujopsene isomer	0.21	Sesquiterpene
β-Chamigrene	1.02	Sesquiterpene
Unknown	0.18	Sesquiterpene
ar-Curcumene	0.21	Sesquiterpene
Unknown	0.21	Sesquiterpene
Pseudowiddrene	1.28	Sesquiterpene
α-Chamigrene	1.16	Sesquiterpene
α-Cuprenene	1.18	Sesquiterpene
Cuparene	1.09	Sesquiterpene
1,2-Dihydrocuparene	0.26	Sesquiterpene
α-Alaskene	0.19	Sesquiterpene
Unknown	0.35	Sesquiterpene
α-Dehydro-ar-himachalene	0.01	Sesquiterpene
β-Curcumene	0.12	Sesquiterpene
1,4-Dihydrocuparene	0.43	Sesquiterpene
7-epi-α-Selinene	0.07	Sesquiterpene
β-Sesquiphellandrene	0.74	Sesquiterpene
γ-Dehydro-ar-himachalene	0.01	Sesquiterpene
δ-Cadinene	0.09	Sesquiterpene
γ-Cuprenene	0.27	Sesquiterpene
Unknown	0.67	Oxygenated sesquiterpene
(E)-γ-Bisabolene	0.20	Sesquiterpene
ar-Himachalene	0.05	Sesquiterpene
δ-Cuprenene epimer II	0.32	Sesquiterpene
δ-Cuprenene epimer I	0.12	Sesquiterpene
Unknown	0.17	Oxygenated sesquiterpene
Unknown	0.06	Oxygenated sesquiterpene
Unknown	0.18	Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.08	Sesquiterpenic alcohol
Caryophyllene oxide	0.04	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
allo-Cedrol	0.46	Sesquiterpenic alcohol
Widdrol	2.45	Sesquiterpenic alcohol
α-Cedrol	20.47	Sesquiterpenic alcohol
epi-Cedrol	0.51	Sesquiterpenic alcohol
β-Himachalene oxide	0.01	Sesquiterpenic ether
10-epi-Cubenol	0.11	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
Unknown	0.16	Oxygenated sesquiterpene
α-Acorenol	0.30	Sesquiterpenic alcohol
Unknown	0.10	Oxygenated sesquiterpene
Unknown	0.20	Oxygenated sesquiterpene
β-Acorenol	0.18	Sesquiterpenic alcohol
Unknown	0.62	Oxygenated sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Himachalol	0.14	Sesquiterpenic alcohol
Unknown	0.18	Oxygenated sesquiterpene
Unknown	0.15	Oxygenated sesquiterpene
Cedrenol analog	0.42	Sesquiterpenic alcohol

14-Hydroxy-9-epi-(<i>E</i>)-caryophyllene	0.21	Sesquiterpenic alcohol
Khusiol	0.11	Sesquiterpenic alcohol
1,7-diepi- α -Cedrenal?	0.12	Sesquiterpenic aldehyde
α -Bisabolol	0.29	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.11	Sesquiterpenic alcohol
α -Cedrenol	0.16	Sesquiterpenic alcohol
Unknown	0.31	Oxygenated sesquiterpene
Thujopsenal	0.19	Sesquiterpenic aldehyde
Mayurone?	0.04	Norsesquiterpenic ketone
Unknown	0.11	Oxygenated sesquiterpene
Thujopsenal analog	0.07	Sesquiterpenic aldehyde
Unknown	0.06	Oxygenated sesquiterpene
Cuparenal	0.04	Sesquiterpenic aldehyde
Unknown	0.07	Oxygenated sesquiterpene
Unknown	0.07	Oxygenated sesquiterpene
Unknown	0.08	Oxygenated sesquiterpene
β -Acoradienol?	0.16	Sesquiterpenic alcohol
Unknown	0.06	Oxygenated sesquiterpene
Unknown	0.03	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.09	Oxygenated sesquiterpene
Nootkatone analog	0.02	Sesquiterpenic ketone
Manool	0.01	Diterpenic alcohol
7,13-Abietadiene	0.01	Diterpene
Consolidated total	94.75%	

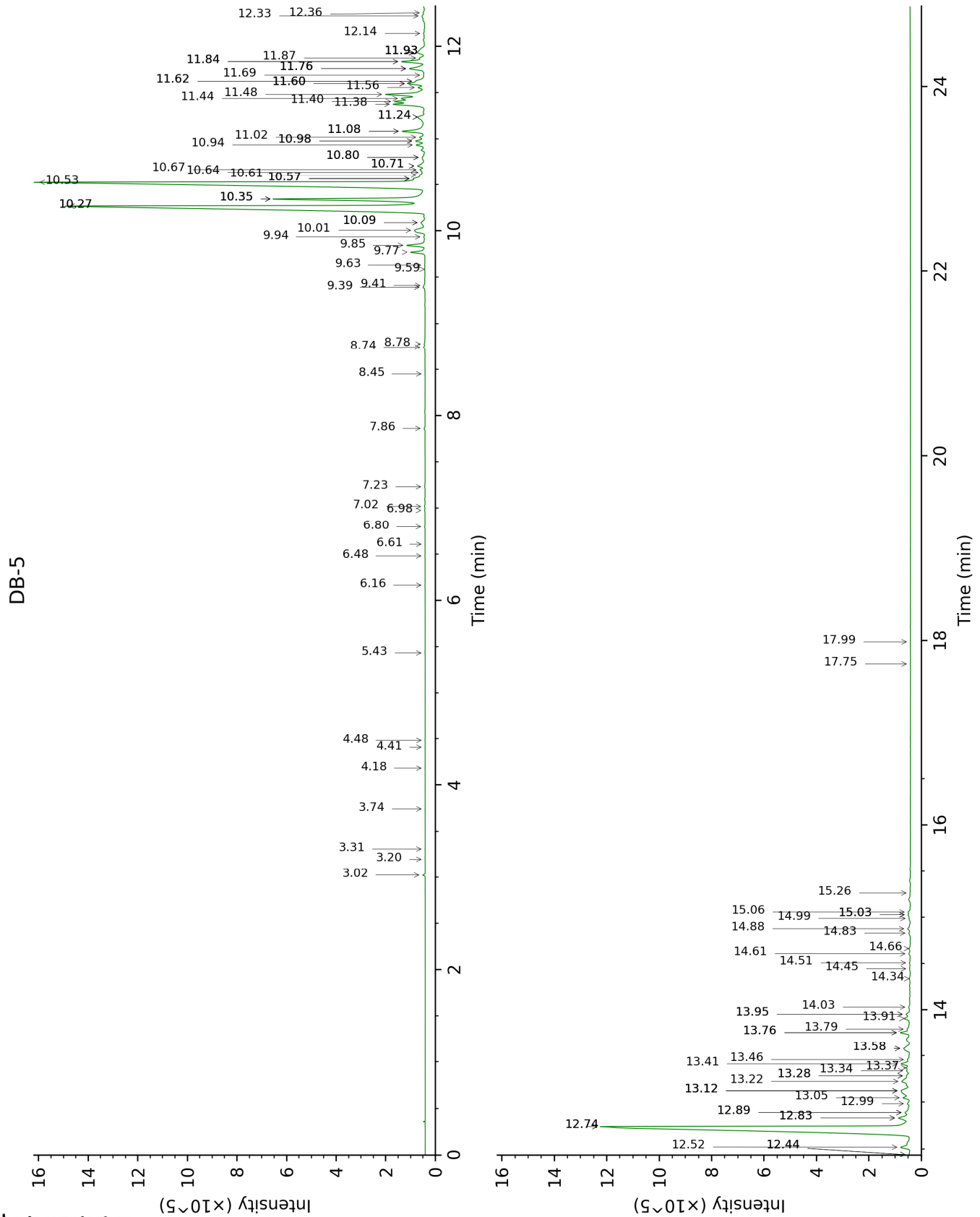
tr: The compound has been detected below 0.005% of total signal.

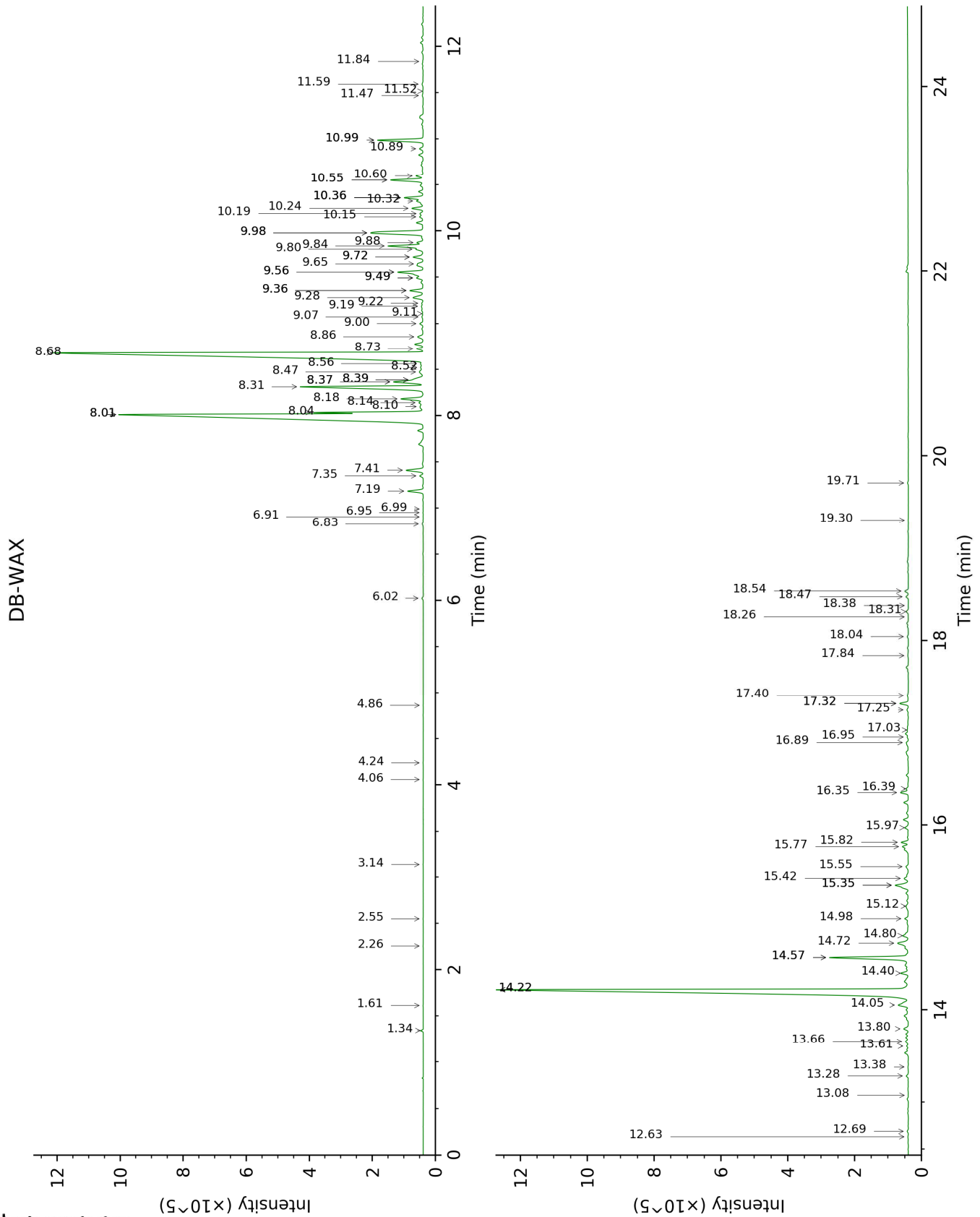
Note: no correction factor was applied

About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

Unknowns: Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

This page was intentionally left blank. The following pages present the complete data of the analysis.





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
α-Pinene	3.02	930	0.06	1.34	991	0.05
α-Fenchene	3.20	941	0.01	1.62	1021	0.01
Thuja-2,4(10)-diene	3.31	949	0.01	2.26	1084	0.01
α-Methylstyrene	3.74	977	0.01	4.86	1284	0.01
Δ3-Carene	4.18	1006	0.01	2.55	1110	0.01
para-Cymene	4.41	1021	0.01	4.06	1226	0.01
Limonene	4.48	1025	0.01	3.14	1156	0.01
Terpinolene	5.43	1085	0.01	4.24	1239	0.01
trans-Pinocarveol	6.16	1132	0.01	9.11	1601	0.02
Citronellal	6.48	1152	0.01	6.95	1436	0.01
Borneol	6.61	1161	tr	9.72*	1651	0.36
Terpinen-4-ol	6.80	1173	0.01	8.52	1556	0.11
para-Cymen-8-ol	6.98	1185	0.01	11.47	1798	0.03
α-Terpineol	7.02	1188	0.02	9.72*	1651	[0.36]
Verbenone	7.23	1201	0.02	9.56*	1638	1.04
Carvacrol methyl ether	7.86	1244	0.04	8.56	1559	0.09
Bornyl acetate	8.45	1284	tr	8.18	1529	0.73
Brasila-1,10-diene	8.74	1304	0.04	6.02	1368	0.04
Carvacrol	8.78	1306	0.02	15.35*	2161	0.62
α-Terpinyl acetate	9.39	1346	0.09	9.65	1645	0.11
African-1-ene	9.41	1347	0.02	6.83	1427	0.04
Cyclosativene I	9.59	1359	0.01	6.91	1433	0.01
Cyclosativene II	9.63	1362	0.01	6.99	1439	0.01
2-epi-α-Funebrene	9.77	1372	0.52	7.19	1454	0.49
α-Duprezianene	9.85	1378	0.72	7.41	1470	0.58
Isolongifolene	9.94	1384	0.05	7.35	1466	0.11
β-Elemene	10.01	1389	0.72	8.37*	1543	1.08
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.09*	1395	0.26	8.10	1523	0.18
α-Chamipinene	10.09*	1395	[0.26]	8.01*	1516	20.21
α-Cedrene	10.27*	1408	22.25	8.01*	1516	[20.21]
β-Funebrene	10.27*	1408	[22.25]	8.04	1518	2.16
β-Caryophyllene	10.35*	1413	6.35	8.37*	1543	[1.08]
β-Cedrene	10.35*	1413	[6.35]	8.31	1539	4.40
β-Duprezianene	10.35*	1413	[6.35]	8.14	1526	0.14
cis-Thujopsene	10.53†	1427	23.19	8.68	1568	22.93
(Z)-β-Farnesene?	10.57*†	1430	[23.19]	9.19	1608	0.08
Isobazzanene	10.57*†	1430	[23.19]	8.47	1552	0.22
Isobarbatene	10.57*†	1430	[23.19]	8.39*	1545	0.33
trans-α-Bergamotene	10.61	1433	0.19	8.39*	1545	[0.33]
β-Barbatene	10.64	1435	0.07	9.00	1593	0.12
Prezizaene	10.67	1437	0.21	8.73	1572	0.19
α-Himachalene	10.71*	1440	0.41	8.86	1582	0.22

7,8-Dehydro- α -acoradiene?	10.71*	1440	[0.41]	9.49*	1633	0.23
Cadina-4,11-diene	10.80*	1447	0.22	9.07	1599	0.05
α -Humulene	10.80*	1447	[0.22]	9.22	1610	0.05
α -Acoradiene	10.94	1457	0.35	9.28	1615	0.43
β -Acoradiene	10.98*	1460	0.36	9.36*	1622	0.44
(<i>E</i>)- β -Farnesene	10.98*	1460	[0.36]	9.49*	1633	[0.23]
Thujopsene isomer	11.02	1463	0.21	9.36*	1622	[0.44]
β -Chamigrene	11.08*	1468	1.21	9.56*	1638	[1.04]
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.08*	1468	[1.21]			
ar-Curcumene	11.24*	1480	0.57	10.60	1724	0.21
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.24*	1480	[0.57]	9.80	1658	0.21
Pseudowiddrene	11.38	1490	1.28	9.84	1661	1.14
α -Chamigrene	11.40	1492	1.16	9.98*	1672	2.34
α -Cuprenene	11.44†	1494	2.75	9.98*	1672	[2.34]
Cuparene	11.48†	1498	[2.75]	10.99*	1757	1.41
1,2-Dihydrocuparene	11.56	1503	0.26	10.19	1689	0.12
α -Alaskene	11.60*†	1506	1.10	9.88	1664	0.19
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122 (24), 95 (23)... 204 (11)]	11.60*†	1506	[1.10]	10.24	1694	0.35
α -Dehydro-ar-himachalene	11.60*†	1506	[1.10]	11.52	1802	0.01
β -Curcumene	11.62*†	1508	[1.10]	10.15	1686	0.12
1,4-Dihydrocuparene	11.62*†	1508	[1.10]	10.36*	1703	0.58
7-epi- α -Selinene	11.69	1514	0.07	10.36*	1703	[0.58]
β -Sesquiphellandrene	11.76*	1519	0.84	10.55*	1720	1.01
γ -Dehydro-ar-himachalene	11.76*	1519	[0.84]	11.84	1830	0.01
δ -Cadinene	11.76*	1519	[0.84]	10.36*	1703	[0.58]
γ -Cuprenene	11.84*	1525	0.94	10.55*	1720	[1.01]
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.84*	1525	[0.94]			
(<i>E</i>)- γ -Bisabolene	11.87	1528	0.20	10.32	1700	0.23
ar-Himachalene	11.93*	1533	0.66	11.59	1808	0.05
δ -Cuprenene epimer II	11.93*	1533	[0.66]	10.99*	1757	[1.41]

δ-Cuprenene epimer I	11.93*	1533	[0.66]	10.90	1749	0.12
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	11.93*	1533	[0.66]	13.80	2010	0.17
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.14	1549	0.06	13.28	1963	0.07
Unknown [m/z 95, 191 (52), 107 (50), 121 (32), 81 (31)...]	12.33	1564	0.18	14.05	2035	0.51
Caryophyllenyl alcohol	12.36	1566	0.08	13.60	1992	0.05
Caryophyllene oxide	12.44*	1572	0.11	12.69	1909	0.04
Caryophyllene oxide isomer	12.44*	1572	[0.11]	12.63	1903	0.02
allo-Cedrol	12.52	1579	0.46	14.22*	2050	20.95
Widdrol	12.74*	1596	22.92	14.57*	2084	2.60
α-Cedrol	12.74*	1596	[22.92]	14.22*	2050	[20.95]
epi-Cedrol	12.83*	1603	0.71	14.72	2098	0.51
β-Himachalene oxide	12.83*	1603	[0.71]	13.08	1944	0.01
10-epi-Cubenol	12.89*	1608	0.28	13.66	1997	0.11
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	12.89*	1608	[0.28]	13.38	1972	0.02
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	12.99	1616	0.16	14.57*	2084	[2.60]
α-Acorenol	13.05	1621	0.30	14.40	2068	0.25
Unknown [m/z 132, 175 (22), 119 (18), 91 (18), 157 (18)... 219 (10)]	13.12*	1627	0.83	15.55	2181	0.10
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.12*	1627	[0.83]	15.82	2208	0.20
β-Acorenol	13.12*	1627	[0.83]	14.80	2106	0.18
Unknown [m/z 132, 91 (24), 119 (22),	13.22	1636	0.62			

105 (21), 133 (17), 117 (16)... 219 (3)]						
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.28*	1640	0.18			
Himachalol	13.28*	1640	[0.18]	15.12	2138	0.14
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.34	1645	0.18	17.32*	2366	0.27
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	13.37	1648	0.15	15.42	2168	0.16
Cedrenol analog	13.41	1651	0.42	16.35	2263	0.24
14-Hydroxy-9-epi- (E)-caryophyllene	13.46	1655	0.21	16.39	2268	0.06
Khusiol	13.58*	1665	0.53	15.97	2224	0.11
1,7-diepi- α - Cedrenal?	13.58*	1665	[0.53]	14.98	2125	0.12
α -Bisabolol	13.76*	1679	0.40	15.35*	2161	[0.62]
Cedr-8-en-13-ol	13.76*	1679	[0.40]	16.89	2320	0.11
α -Cedrenol	13.79	1682	0.16	16.95	2327	0.04
Unknown [m/z 91, 105 (87), 123 (74), 135 (70), 107 (60), 79 (59)... 220 (13)]	13.91	1692	0.31			
Thujopsenal	13.95*	1696	0.22	15.77	2203	0.19
Mayurone?	13.95*	1696	[0.22]	17.03	2335	0.04
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.03	1702	0.11	17.40	2375	0.05
Thujopsenal analog	14.34	1728	0.07	17.32*	2366	[0.27]
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.44	1738	0.06			
Cuparenal	14.51	1743	0.04			
Unknown [m/z 105, 69 (79), 111 (66), 119 (60), 91 (50), 55 (41)... 203 (11), 220 (1)]	14.61	1752	0.07			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.66	1757	0.07	18.31	2476	0.08

Unknown [m/z 121, 136 (47), 119 (27), 91 (27), 105 (22), 41 (21)... 220 (4)]	14.83	1771	0.08	18.38	2484	0.01
β-Acoradienol?	14.88	1775	0.16	18.04	2446	0.04
Unknown [m/z 189, 91 (48), 133 (40), 105 (40), 41 (34), 187 (34)... 220 (5)]	14.99	1785	0.06	18.54	2501	0.11
Unknown [m/z 148, 141 (99), 91 (74), 105 (52), 41 (42), 121 (42), 133 (37)... 218 (32)]	15.03*	1788	0.11	19.71	2639	0.03
Unknown [m/z 120, 121 (93), 93 (85), 105 (74), 119 (68), 91 (58), 123 (49)... 220 (8)]	15.03*	1788	[0.11]	18.26	2470	0.01
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.06	1791	0.09	18.47	2494	0.07
Nootkatone analog	15.26	1809	0.02	17.84	2423	0.03
Manool	17.75	2042	0.01	19.30	2590	0.01
7,13-Abietadiene	17.99	2065	0.01	17.25	2358	0.06
Total identified		95.79%			91.54%	
Total reported		97.98%			93.86%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

†: Peaks apexes were resolved, but peaks overlapped and were summed for analysis

tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index