

**Date :** March 07, 2018

**CERTIFICATE OF ANALYSIS - GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 18B20-PLG25-1-CC  
**Customer identification :** Cedarwood Atlas  
**Type :** Essential oil  
**Source :** *Cedrus atlantica*  
**Customer :** Plant Guru

*ANALYSIS*

**Method:** PC-PA-014-17J19 - 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 :** February 28, 2018

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Light yellow liquid

**Refractive index:**  $1.5113 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Mesityl oxide	0.02	0.02	Aliphatic ketone
$\alpha$ -Pinene	0.01	0.02	Monoterpene
Limonene	0.01	0.01	Monoterpene
Terpinolene	0.01*		Monoterpene
para-Cymenene	[0.01]*	0.01	Monoterpene
Limona ketone	0.53	0.47*	Normonoterpenic ketone
4-Methylacetophenone	0.08	0.08	Simple phenolic
$\alpha$ -Terpineol	0.03	0.01	Monoterpenic alcohol
$\alpha$ -Longipinene	0.07	0.07	Sesquiterpene
Longicyclene	0.02	0.02	Sesquiterpene
$\alpha$ -Ylangene	0.07	0.03	Sesquiterpene
Unknown	0.22	0.23	Sesquiterpene
Unknown	0.41	0.41	Sesquiterpene
Sativene	0.03	0.03	Sesquiterpene
Sibirene	1.10*	0.57	Sesquiterpene
Longifolene	[1.10]*	0.56*	Sesquiterpene
$\alpha$ -Cedrene	0.09	[0.56]*	Sesquiterpene
$\beta$ -Caryophyllene	0.04	0.03	Sesquiterpene
Himachala-2,4-diene	0.47	[0.47]*	Sesquiterpene
Unknown	0.08		Sesquiterpene
Unknown	0.05		Sesquiterpene
Himachala-2,4-diene isomer	0.17	0.17	Sesquiterpene
$\alpha$ -Himachalene	16.03	15.55	Sesquiterpene
( <i>E</i> )-Vestitenone	0.08	0.46	Terpenic ketone
Unknown	0.39	0.52	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.24	9.59*	Sesquiterpene
Unknown	0.59	0.42	Sesquiterpene
Unknown	0.23		Sesquiterpene
$\gamma$ -Himachalene	9.32	[9.59]*	Sesquiterpene
11- $\alpha$ H-Himachala-1,4-diene	2.14	1.61	Sesquiterpene
Unknown	0.34	0.36	Sesquiterpenic ether
$\beta$ -Himachalene	43.82*	43.27	Sesquiterpene
$\alpha$ -Muurolene	[43.82]*	0.14	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.34*	1.63*	Sesquiterpene
Cycloisolongifol-5-ol	[0.34]*	0.17	Sesquiterpenic alcohol
$\alpha$ -Dehydro-ar-himachalene	1.29*	1.24	Sesquiterpene
$\gamma$ -Cadinene	[1.29]*	0.02	Sesquiterpene
<i>trans</i> -Calamenene	3.90*	0.14	Sesquiterpene
$\gamma$ -Dehydro-ar-himachalene	[3.90]*	1.22	Sesquiterpene
$\delta$ -Cadinene	[3.90]*	[1.63]*	Sesquiterpene
Unknown	[3.90]	1.03	Sesquiterpene
ar-Himachalene	0.43	0.42	Sesquiterpene
$\alpha$ -Calacorene	0.70	0.69	Sesquiterpene
( <i>E</i> )- $\alpha$ -Bisabolene	0.56	0.55	Sesquiterpene
Unknown	0.10	0.22	Oxygenated sesquiterpene
( <i>E</i> )-Nerolidol	0.10	0.59*	Sesquiterpenic alcohol
Unknown	0.63	0.22*	Unknown
Himachalene epoxide	[0.63]	0.46	Sesquiterpenic ether

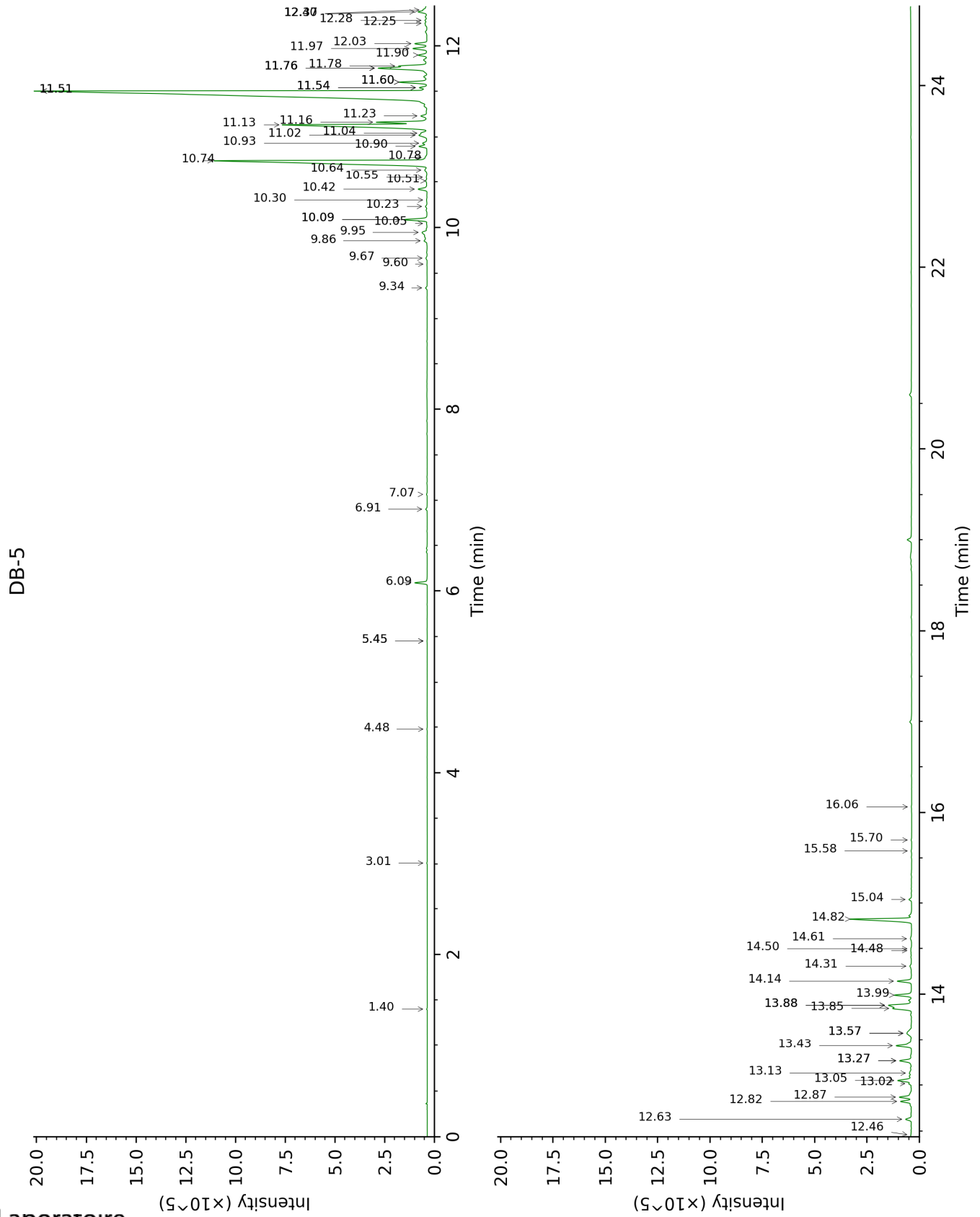
Unknown	0.03	0.03	Oxygenated sesquiterpene
Longiborneol	0.31	0.32	Sesquiterpenic alcohol
$\beta$ -Himachalene oxide	1.24	0.56	Sesquiterpenic ether
Unknown	[1.24]	0.59	Oxygenated sesquiterpene
Unknown	0.11	[0.22]*	Oxygenated sesquiterpene
1-epi-Cubenol	0.75	[0.59]*	Sesquiterpenic alcohol
Unknown	0.15		Oxygenated sesquiterpene
Himachalol	0.68*	0.58	Sesquiterpenic alcohol
Unknown	[0.68]*		Oxygenated sesquiterpene
Allohimachalol	0.90	0.77	Sesquiterpenic alcohol
( <i>E</i> )-10,11-Dihydroatlantone	0.53*	0.11	Sesquiterpenic ketone
$\beta$ -Atlantone	[0.53]*	0.27	Sesquiterpenic ketone
( <i>Z</i> )- $\gamma$ -Atlantone	0.85	0.67	Sesquiterpenic ketone
Deodarone epimer II	1.58*	0.86	Sesquiterpenic ketone
Deodarone epimer I	[1.58]*	0.76	Sesquiterpenic ketone
( <i>E</i> )- $\gamma$ -Atlantone	0.81	0.93	Sesquiterpenic ketone
( <i>Z</i> )- $\alpha$ -Atlantone	0.68	0.59	Sesquiterpenic ketone
Unknown	0.10		Oxygenated sesquiterpene
Unknown	0.04		Oxygenated sesquiterpene
Unknown	0.03		Oxygenated sesquiterpene
Unknown	0.09		Oxygenated sesquiterpene
( <i>E</i> )- $\alpha$ -Atlantone	3.22	3.09	Sesquiterpenic ketone
Unknown	0.14		Oxygenated sesquiterpene
Unknown	0.03		Oxygenated sesquiterpene
Unknown	0.03		Oxygenated sesquiterpene
Unknown	0.02		Oxygenated sesquiterpene
<b>Total identified</b>	<b>91.59%</b>	<b>89.55%</b>	

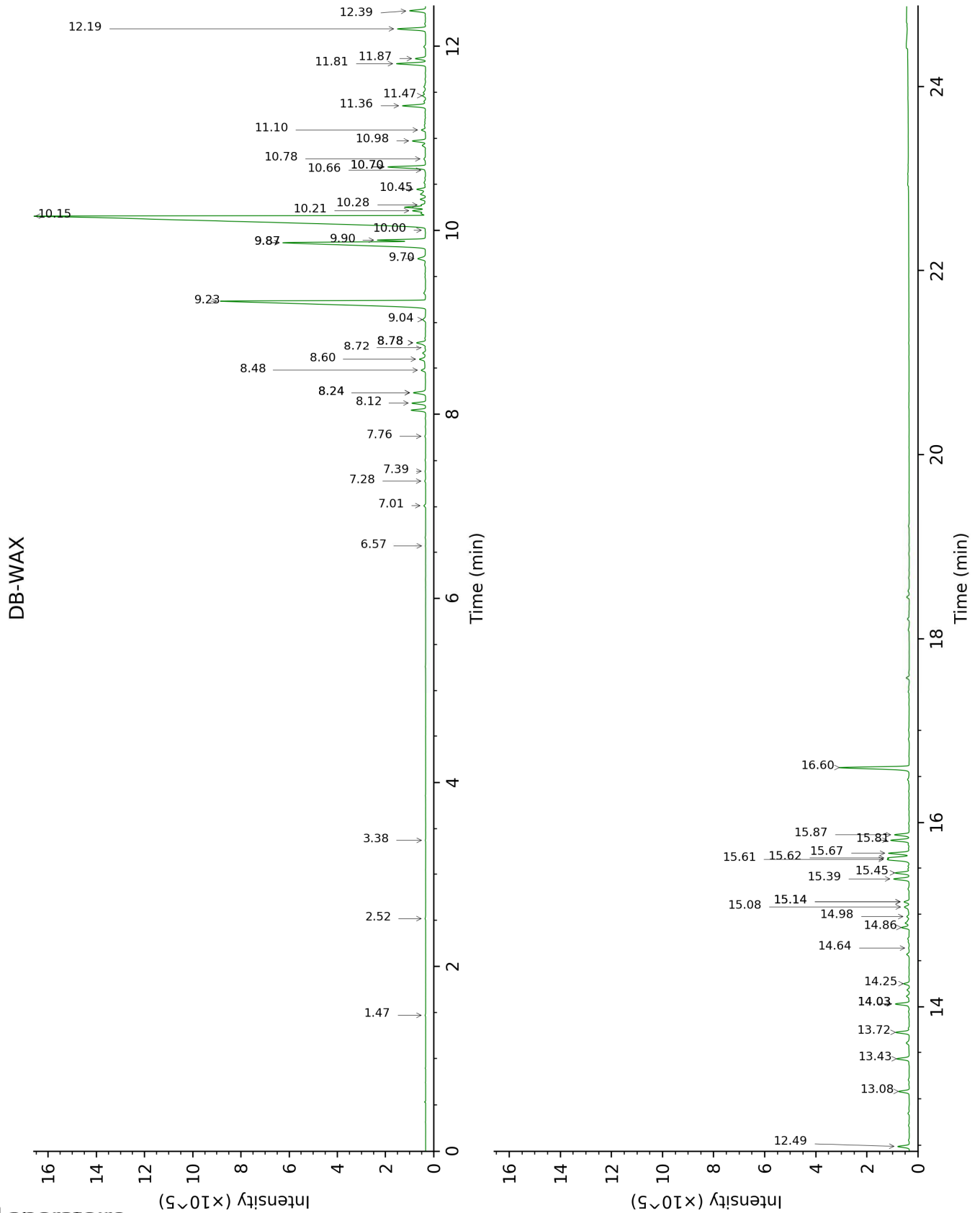
\*: Two or more compounds are coeluting on this column

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Mesityl oxide	1.40	793	0.02	2.52	1094	0.02
$\alpha$ -Pinene	3.01	925	0.01	1.47	995	0.02
Limonene	4.48	1022	0.01	3.38	1159	0.01
Terpinolene	5.45*	1083	0.01			
para-Cymenene	5.45*	1083	[0.01]	6.57	1388	0.01
Limona ketone	6.09	1123	0.53	8.78*	1554	0.47
4-Methylacetophenone	6.91	1175	0.08	10.78	1714	0.08
$\alpha$ -Terpineol	7.07	1185	0.03	10.00	1650	0.01
$\alpha$ -Longipinene	9.34	1338	0.07	7.01	1421	0.07
Longicyclene	9.60	1356	0.02	7.39	1448	0.02
$\alpha$ -Ylangene	9.67	1361	0.07	7.28	1440	0.03
Unknown epimer I [m/z 131, 146 (36), 91 (22), 145 (19), 202 (18)]	9.86	1374	0.22	8.48	1530	0.23
Unknown epimer II [m/z 131, 146 (33), 91 (20), 202 (18)]	9.95	1381	0.41	8.60	1540	0.41
Sativene	10.05	1388	0.03	7.76	1476	0.03
Sibirene	10.09*	1391	1.10	8.12	1503	0.57
Longifolene	10.09*	1391	[1.10]	8.24*	1512	0.56
$\alpha$ -Cedrene	10.23	1401	0.09	8.24*	1512	[0.56]
$\beta$ -Caryophyllene	10.30	1406	0.04	8.72	1549	0.03
Himachala-2,4-diene	10.42	1415	0.47	8.78*	1554	[0.47]
Unknown [m/z 91, 93 (90), 105 (72), 202 (71), 131 (68), 77 (63), 107 (55), 187 (54)]	10.51	1422	0.08			
Unknown [m/z 105, 91 (70), 93 (65), 43 (61), 120 (57), 145 (50)... 204 (6)]	10.55	1425	0.05			
Himachala-2,4-diene isomer	10.64	1431	0.17	9.04	1573	0.17
$\alpha$ -Himachalene	10.74	1439	16.03	9.24	1588	15.55
(E)-Vestitenone	10.78	1441	0.08	12.49	1861	0.46
Unknown [m/z 187, 131 (78), 202 (76), 105 (74), 91 (74), 117 (53), 145 (52)]	10.90	1451	0.39	10.21	1667	0.52
(E)- $\beta$ -Farnesene	10.93	1453	0.24	9.87*	1639	9.59
Unknown [m/z 119, 91 (85), 93 (77), 105 (76), 79 (61), 134 (60), 94 (49), 204 (46)]	11.02	1460	0.59	9.70	1625	0.42
Unknown [m/z 131, 202 (78), 91 (74), 105	11.04	1461	0.23			



(68), 187 (68), 119 (53), 145 (52)]						
$\gamma$ -Himachalene	11.14	1468	9.32	9.87*	1639	[9.59]
11- $\alpha$ H-Himachala-1,4-diene	11.16	1470	2.14	9.90	1642	1.61
Unknown [m/z 137, 43 (84), 138 (63), 109 (53), 95 (51), 93 (50), 207 (46)... 222 (21)]	11.23	1475	0.34	10.45	1686	0.36
$\beta$ -Himachalene	11.51*	1496	43.82	10.16	1662	43.27
$\alpha$ -Muurolene	11.51*	1496	[43.82]	10.28	1672	0.14
(Z)- $\alpha$ -Bisabolene	11.54*	1498	0.34	10.70*	1707	1.63
Cycloisolongifol-5-ol	11.54*	1498	[0.34]	11.10	1740	0.17
$\alpha$ -Dehydro-ar-himachalene	11.60*	1503	1.29	11.81	1801	1.24
$\gamma$ -Cadinene	11.60*	1503	[1.29]	10.66	1704	0.02
<i>trans</i> -Calamenene	11.76*†	1515	3.90	11.47	1772	0.14
$\gamma$ -Dehydro-ar-himachalene	11.76*†	1515	[3.90]	12.19	1834	1.22
$\delta$ -Cadinene	11.76*†	1515	[3.90]	10.70*	1707	[1.63]
Unknown [m/z 131, 202 (28), 91 (22), 159 (16), 145 (16), 132 (15), 115 (14)]	11.78†	1517	[3.90]	11.36	1762	1.03
ar-Himachalene	11.90	1526	0.43	11.87	1806	0.42
$\alpha$ -Calacorene	11.97	1532	0.70	12.39	1852	0.69
(E)- $\alpha$ -Bisabolene	12.02	1536	0.56	10.98	1730	0.55
Unknown [m/z 189, 91 (85), 43 (74), 105 (67), 133 (66), 107 (63), 135 (52)... 220 (20)]	12.25	1554	0.10	14.25	2023	0.22
(E)-Nerolidol	12.28	1556	0.10	14.03*	2002	0.59
Unknown [m/z 96, 95 (18), 83 (15), 125 (13), 119 (12), 55 (12), 41 (11)... 218? (tr)]	12.37†	1563	0.63	15.14*	2109	0.22
Himachalene epoxide	12.40†	1565	[0.63]	13.08	1914	0.46
Unknown [m/z 177, 202 (79), 91 (76), 159 (75), 43 (65), 107 (59), 105 (57)...]	12.46	1570	0.03	14.64	2060	0.03
Longiborneol	12.63	1583	0.31	14.86	2081	0.32
$\beta$ -Himachalene oxide	12.82†	1598	1.24	13.43	1946	0.56
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	12.87†	1602	[1.24]	13.72	1973	0.59
Unknown [m/z 137, 119 (69), 43 (51), 95	13.02	1614	0.11	15.14*	2109	[0.22]

(50), 109 )40)... 222 (1)]						
1-epi-Cubenol	13.05	1617	0.75	14.03*	2002	[0.59]
Unknown [m/z 119, 163 (80), 107 (64), 95 (61), 93 (57), 91 (53)... 220 (11)]	13.13	1624	0.15			
Himachalol	13.27*	1635	0.68	15.45	2140	0.58
Unknown [m/z 119, 91 (44), 94 (36), 107 (35), 93 (29)... 202 (19)...]	13.27*	1635	[0.68]			
Allohimachalol	13.43	1648	0.90	15.81	2176	0.77
(E)-10,11- Dihydroatlantone	13.57*	1660	0.53	14.98	2093	0.11
$\beta$ -Atlantone	13.57*	1660	[0.53]	15.08	2103	0.27
(Z)- $\gamma$ -Atlantone	13.85	1682	0.85	15.39	2133	0.67
Deodarone epimer II	13.88*	1685	1.58	15.67	2162	0.86
Deodarone epimer I	13.88*	1685	[1.58]	15.62	2157	0.76
(E)- $\gamma$ -Atlantone	13.99	1694	0.81	15.60	2155	0.93
(Z)- $\alpha$ -Atlantone	14.14	1708	0.68	15.87	2182	0.59
Unknown [m/z 105, 119 (89), 59 (68), 120 (65), 43 (65), 93 (62), 121 (61)...]	14.31	1722	0.10			
Unknown [m/z 83, 91 (28), 105 (25), 55 (21), 43 (17), 119 (17)...]	14.48	1736	0.04			
Unknown [m/z 43, 105 (99), 119 (90), 91 (87), 147 (76), 41 (69), 93 (63)...]	14.50	1738	0.03			
Unknown [m/z 83, 55 (17), 91 (14), 105 (9), 216 (6)...]	14.61	1748	0.09			
(E)- $\alpha$ -Atlantone	14.82	1766	3.22	16.60	2257	3.09
Unknown [m/z 95, 43 (59), 69, (57), 67 (43), 163 (42), 94 (37), 107 (37)... 178 (26), 218 (2)]	15.04	1785	0.14			
Unknown [m/z 83, 134 (28), 119 (19), 55 (18), 91 (14), 43 (11), 109 (10)... 216 (4), 249? (0)]	15.58	1833	0.03			
Unknown [m/z 83, 134 (30), 119 (19), 55 (18), 91 (12)... 216 (4)...]	15.70	1844	0.03			
Unknown [m/z 173, 83 (83), 91 (80), 201	16.06	1877	0.02			

(79), 115 (65)... 216 (31)]		
<b>Total identified</b>	<b>91.59%</b>	<b>89.55%</b>
<b>Total reported</b>	<b>97.06%</b>	<b>93.36%</b>

\*: Two or more compounds are coeluting on this column

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

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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index