Date : August 29, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19H15-PTH06-1-SCC
Customer identification : Douglas Fir - Canada - DC010195R
Type : Essential oil
Source : *Pseudotsuga menziesii* var. *"Coastal"*
Customer : Plant Therapy

Analysis

Method: PC-PA-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 : Lindsay Girard, B. Sc.
Analysis date : August 28, 2019

Checked and approved by :

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

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.

Laboratoire PhytoChemia
628 Boulevard du Saguenay Ouest, Saguenay (Qc) G7J 1H4 | www.phytochemia.com

PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4754 ± 0.0003 (20 °C)

CONCLUSION

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

628 Boulevard du Saguenay, Saguenay (Qc) G7J 1H4 | www.phytochemia.com

Analysis summary – Consolidated contents

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

Identification	%	Classe
Acetone	0.02	Aliphatic ketone
Toluene	tr	Simple phenolic
Ethyl 2-methylbutyrate	0.02	Aliphatic ester
Unknown	0.01	Unknown
Santene	0.02	Monoterpene
Styrene	0.01	Simple phenolic
Hashishene	0.01	Monoterpene
Tricyclene	0.09	Monoterpene
α-Thujene	0.69	Monoterpene
α-Pinene	11.19	Monoterpene
Camphene	0.84	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
β-Pinene	32.92	Monoterpene
Sabinene	8.86	Monoterpene
Myrcene	1.87	Monoterpene
α-Phellandrene	0.26	Monoterpene
Ethyl hexanoate	0.11	Aliphatic ester
Δ3-Carene	4.05	Monoterpene
α-Terpinene	2.15	Monoterpene
para-Cymene	1.02	Monoterpene
Limonene	2.29	Monoterpene
1,8-Cineole	1.28*	Monoterpenic ether
β-Phellandrene	[1.28]*	Monoterpene
(*Z*)-β-Ocimene	0.30	Monoterpene
(*E*)-β-Ocimene	0.16	Monoterpene
Unknown	0.05	Unknown
γ-Terpinene	3.88	Monoterpene
cis-Sabinene hydrate	0.04	Monoterpenic alcohol
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Terpinolene isomer	0.13	Monoterpene
Terpinolene	13.74	Monoterpene
para-Cymenene	0.10	Monoterpene
α-Pinene oxide	0.03	Monoterpenic ether
trans-Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	0.13	Monoterpenic alcohol
Unknown	0.03	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.02	Monoterpene
endo-Fenchol	0.06	Monoterpenic alcohol
(*E*)-4,8-Dimethylnona-1,3,7-triene	0.01	Terpene derivative
cis-para-Menth-2-en-1-ol	0.11	Monoterpenic alcohol
Cosmene?	0.01	Monoterpene
Methyl octanoate	0.03	Aliphatic ester
1-Terpineol	0.02	Monoterpenic alcohol
trans-Pinocarveol	0.08	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.08	Monoterpenic alcohol
Epoxyterpinolene	0.12	Monoterpenic ether

Camphene hydrate	0.09	Monoterpenic alcohol
Citronellal	0.14	Monoterpenic aldehyde
Pinocarvone	0.01	Monoterpenic ketone
Borneol	0.04	Monoterpenic alcohol
Unknown	0.07	Oxygenated monoterpene
Terpinen-4-ol	3.91	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
para-Cymen-8-ol	0.14	Monoterpenic alcohol
α-Terpineol	0.61	Monoterpenic alcohol
Myrtenol	0.05	Monoterpenic alcohol
Ethyl octanoate	0.04	Aliphatic ester
Unknown	0.08	Oxygenated monoterpene
trans-Piperitol	0.04	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Citronellol	0.61	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol
Thymol methyl ether	0.12	Monoterpenic ether
Neral	0.02	Monoterpenic aldehyde
Piperitone	0.03	Monoterpenic ketone
Geraniol	0.05	Monoterpenic alcohol
Unknown	0.02	Unknown
Unknown	0.08	Oxygenated monoterpene
Bornyl acetate	0.37	Monoterpenic ester
Unknown	0.07	Unknown
Isoascaridole	0.01	Monoterpenic ether
Unknown	0.02	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Citronellic acid	0.14	Monoterpenic acid
δ-Elemene	0.02	Sesquiterpene
α-Longipinene	0.03	Sesquiterpene
Citronellyl acetate	1.75	Monoterpenic ester
Unknown	0.05	Unknown
Unknown	0.01	Unknown
Geranyl acetate	1.37	Monoterpenic ester
β-Elemene	0.04	Sesquiterpene
Ethyl decanoate	0.05	Aliphatic ester
β-Caryophyllene	0.04	Sesquiterpene
β-Copaene	0.01	Sesquiterpene
Unknown	0.03	Oxygenated monoterpene
trans-α-Bergamotene	0.02	Sesquiterpene
Unknown	0.04	Sesquiterpene
α-Humulene	0.08	Sesquiterpene
(*E*)-β-Farnesene	0.03	Sesquiterpene
γ-Muurolene	0.07	Sesquiterpene
Unknown	0.02	Sesquiterpene
δ-Selinene	0.02	Sesquiterpene
Methyl (*E*)-isoeugenol	0.03	Phenylpropanoid
(*Z*)-α-Bisabolene	0.02	Sesquiterpene
γ-Cadinene	0.10	Sesquiterpene
δ-Cadinene	0.09	Sesquiterpene
(*E*)-α-Bisabolene	0.02	Sesquiterpene
Caryophyllene oxide	0.02	Sesquiterpenic ether

Selin-6-en-4α-ol isomer	0.10	Sesquiterpenic alcohol
Cubenol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
τ-Muurolol	0.01	Sesquiterpenic alcohol
β-Eudesmol	0.02	Sesquiterpenic alcohol
(2*E*,6*E*)-Farnesol	0.04	Sesquiterpenic alcohol
Unknown	0.01	Unknown
(2*E*,6*E*)-Farnesyl acetate	0.01	Sesquiterpenic ester
Cembrene?	0.01	Diterpene
Thunbergol?	0.01	Diterpenic alcohol
(*Z*)-Abienol	0.02	Diterpenic alcohol
Consolidated total	**97.95%**	

*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
tr: The compound has been detected below 0.005% of total signal.

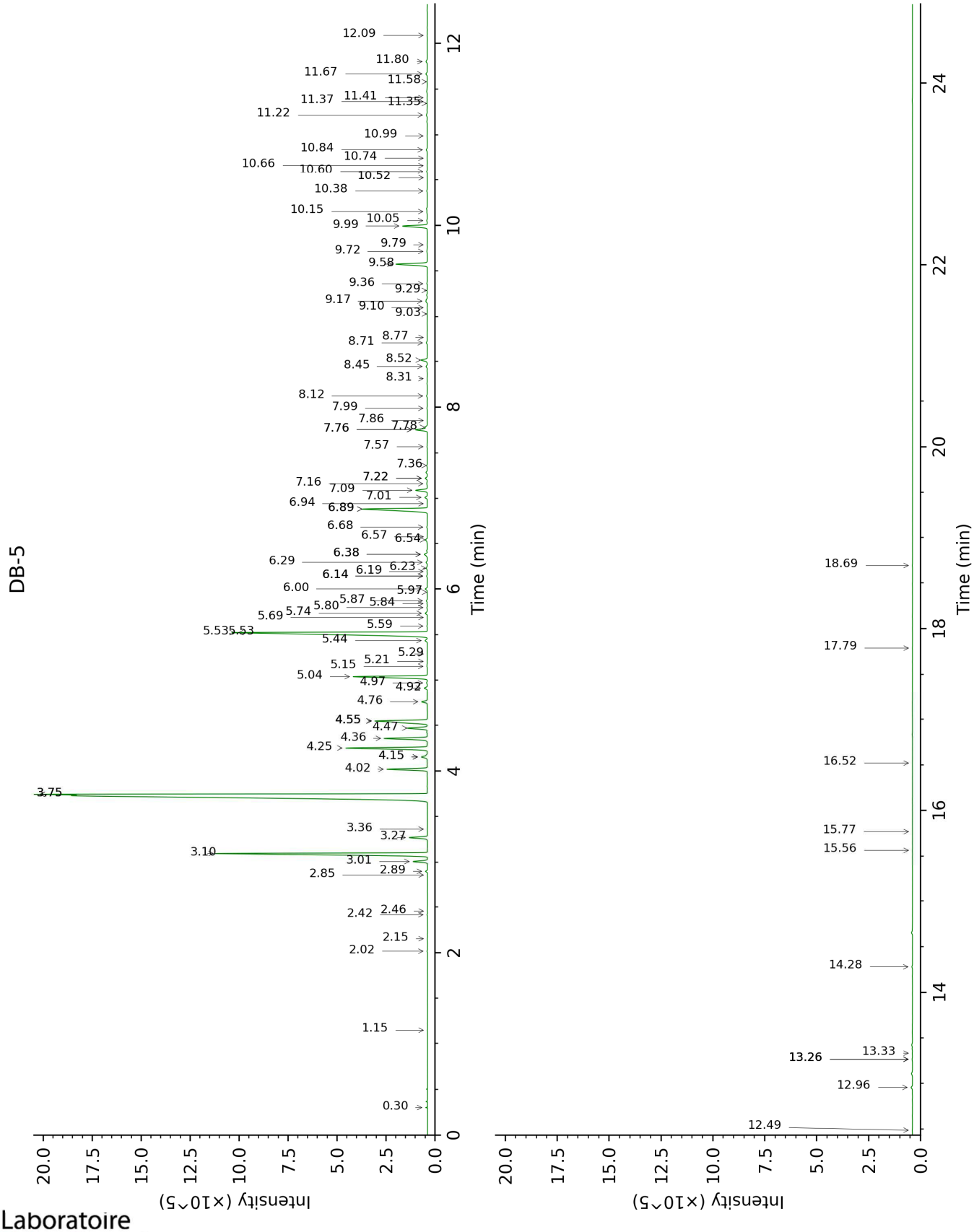
Note: no correction factor was applied

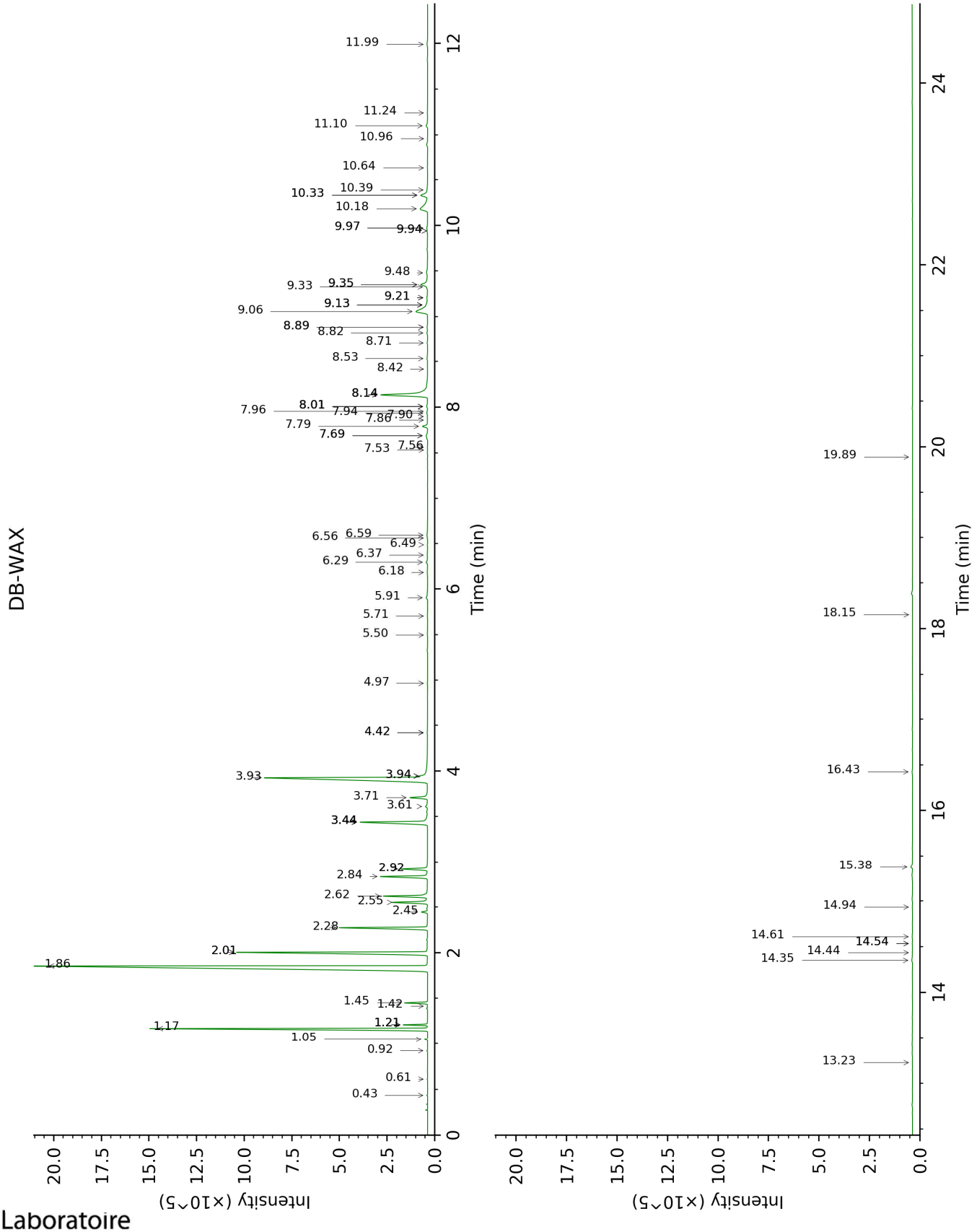
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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.

628 Boulevard du Saguenay, Saguenay (Qc) G7J 1H4 | www.phytochemia.com


DB-5
Time (min)
Intensity (×10^5)
12.09
11.80
11.67
11.58
11.37
11.41
11.35
11.22
10.99
10.84
10.74
10.66
10.60
10.52
10.38
10.15
10.05
9.99
9.79
9.72
9.58
9.36
9.29
9.17
9.10
9.03
8.77
8.71
8.52
8.45
8.31
8.12
7.99
7.86
7.78
7.76
7.57
7.36
7.22
7.16
7.09
7.01
6.94
6.89
6.68
6.57
6.54
6.38
6.29
6.23
6.19
6.14
6.00
5.97
5.87
5.84
5.80
5.74
5.69
5.59
5.53
5.53
5.44
5.29
5.21
5.15
5.04
4.97
4.92
4.76
4.55
4.47
4.36
4.25
4.15
4.02
3.75
3.36
3.27
3.10
3.01
2.89
2.85
2.46
2.42
2.15
2.02
1.15
0.30
18.69
17.79
16.52
15.77
15.56
14.28
13.33
13.26
12.96
12.49


DB-WAX
Time (min)
Intensity (×10^5)
11.99
11.24
11.10
10.96
10.64
10.39
10.33
10.18
9.97
9.94
9.48
9.35
9.33
9.21
9.13
9.06
8.89
8.82
8.71
8.53
8.42
8.14
8.01
7.96
7.94
7.90
7.86
7.79
7.69
7.56
7.53
6.59
6.56
6.49
6.37
6.29
6.18
5.91
5.71
5.50
4.97
4.42
3.94
3.93
3.71
3.61
3.44
2.92
2.84
2.62
2.55
2.45
2.28
2.01
1.86
1.45
1.42
1.21
1.17
1.05
0.92
0.61
0.43
19.89
18.15
16.43
15.38
14.94
14.61
14.54
14.44
14.35
13.23

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Acetone	0.30	515	0.02	0.44	786	0.02
Toluene	1.15	760	tr	1.21*	1000	0.70
Ethyl 2-methylbutyrate	2.02	850	0.02	1.42	1024	0.01
Unknown [m/z 55, 83 (89), 82 (70), 67 (66), 41 (55), 69 (46), 111 (37)... 126 (2)]	2.16	861	0.01	0.61	873	0.01
Santene	2.42	882	0.02	0.92	948	0.02
Styrene	2.46	886	0.01	3.44*	1206	4.15
Hashishene	2.85	915	0.01	1.21*	1000	[0.70]
Tricyclene	2.89	918	0.09	1.05	971	0.09
α-Thujene	3.01	925	0.69	1.21*	1000	[0.70]
α-Pinene	3.10	931	11.19	1.17	993	11.53
Camphene	3.27	943	0.84	1.45	1027	0.83
Thuja-2,4(10)-diene	3.36	949	0.01	2.01*	1085	9.88
β-Pinene	3.74*	974	41.78	1.86	1070	32.92
Sabinene	3.74*	974	[41.78]	2.01*	1085	[9.88]
Myrcene	4.02	992	1.87	2.55	1134	1.76
α-Phellandrene	4.15*	1001	0.37	2.45	1126	0.26
Ethyl hexanoate	4.15*	1001	[0.37]	3.44*	1206	[4.15]
Δ3-Carene	4.25	1007	4.05	2.28	1112	4.09
α-Terpinene	4.36	1014	2.15	2.62	1140	2.20
para-Cymene	4.47	1021	1.02	3.71	1226	0.98
Limonene	4.55*	1026	3.57	2.84	1157	2.29
1,8-Cineole	4.55*	1026	[3.57]	2.92*	1164	1.27
β-Phellandrene	4.55*	1026	[3.57]	2.92*	1164	[1.27]
(*Z*)-β-Ocimene	4.76	1039	0.30	3.44*	1206	[4.15]
(*E*)-β-Ocimene	4.92	1049	0.16	3.61	1219	0.15
Unknown [m/z 115, 97 (84), 155 (69), 55 (51), 69 (50), 43 (46)...]	4.97	1052	0.05	3.94*†	1244	[13.92]
γ-Terpinene	5.04	1057	3.88	3.44*	1206	[4.15]
cis-Sabinene hydrate	5.15	1064	0.04	6.49	1428	0.02
Unknown [m/z 115, 43 (92), 97 (92), 69 (70), 155 (70), 55 (69)...]	5.21	1067	0.01			
Unknown [m/z 101, 88 (98), 43 (54), 55 (44), 41 (40), 95 (40), 73 (36)...]	5.29	1072	0.01	4.42*	1280	0.02
Terpinolene	5.44	1082	0.13	3.94*†	1244	[13.92]

isomer						
Terpinolene	5.52*	1087	13.97	3.93†	1243	13.92
para-Cymenene	5.52*	1087	[13.97]	5.91	1385	0.10
α-Pinene oxide	5.60	1092	0.03	4.97	1316	0.02
trans-Sabinene hydrate	5.69	1098	0.01	7.56	1510	0.02
Linalool	5.74	1100	0.13	7.69*	1520	0.15
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.80	1104	0.03	8.14*	1555	4.02
para-Mentha-1,3,8-triene	5.84	1107	0.02	5.70	1370	0.03
endo-Fenchol	5.87	1109	0.06	7.94	1539	0.05
(*E*)-4,8-Dimethylnona-1,3,7-triene	5.97	1115	0.01	4.42*	1280	[0.02]
cis-para-Menth-2-en-1-ol	6.00	1118	0.11	7.69*	1520	[0.15]
Cosmene?	6.14*	1127	0.05			
Methyl octanoate	6.14*	1127	[0.05]	5.50	1355	0.03
1-Terpineol	6.19	1130	0.02	7.86	1533	0.02
trans-Pinocarveol	6.23	1132	0.08	8.71	1600	0.04
trans-para-Menth-2-en-1-ol	6.29	1137	0.08	8.53	1586	0.05
Epoxyterpinolene	6.38*	1142	0.21	6.30	1414	0.12
Camphene hydrate	6.38*	1142	[0.21]	8.14*	1555	[4.02]
Citronellal	6.54	1152	0.14	6.59	1436	0.10
Pinocarvone	6.57	1155	0.01	7.53	1507	0.01
Borneol	6.68	1162	0.04	9.35*	1653	0.68
Unknown [m/z 69, 84 (62), 41 (30), 123 (26), 97 (24), 109 (23)...]	6.89*	1175	4.21	9.13*	1634	0.12
Terpinen-4-ol	6.89*	1175	[4.21]	8.14*	1555	[4.02]
Unknown [m/z 96, 119 (99), 96 (86), 91 (81), 43 (65), 41 (49), 67 (45)...]	6.94	1179	0.01			
para-Cymen-8-ol	7.01	1183	0.14	11.10	1800	0.16
α-Terpineol	7.09	1188	0.61	9.35*	1653	[0.68]
Myrtenol	7.16	1193	0.05	10.39	1739	0.07
Ethyl octanoate	7.22*	1197	0.12	6.18	1405	0.04
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.22*	1197	[0.12]			

trans-Piperitol	7.36	1206	0.04	9.94*	1701	0.04
Unknown [m/z 122, 91 (56), 79 (33), 95 (33), 107 (31), 43 (30), 77 (30), 135 (27)... 150 (9)]	7.57	1220	0.02	8.89*	1614	0.06
Citronellol	7.76*	1233	0.64	10.33*	1734	0.68
Nerol	7.76*	1233	[0.64]	10.64	1761	0.03
Thymol methyl ether	7.78	1235	0.12	8.01*	1545	0.08
Neral	7.86	1240	0.02	9.13*	1634	[0.12]
Piperitone	7.99	1249	0.03	9.48	1663	0.15
Geraniol	8.12	1258	0.05	11.24	1813	0.04
Unknown [m/z 88, 101 (61), 55 (39), 41 (34), 83 (30), 70 (24), 43 (24)...]	8.31	1272	0.02			
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.45	1281	0.08	11.99	1880	0.09
Bornyl acetate	8.52	1286	0.37	7.79	1528	0.33
Unknown [m/z 112, 97 (93), 83 (60), 43 (46), 41 (20), 69 (19)...]	8.71	1299	0.07			
Isoascaridole	8.77	1303	0.01	10.96	1788	0.01
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.03	1316	0.02	14.54*	2121	0.01
Unknown [m/z 91, 79 (94), 77 (72), 41 (37), 93 (31)... 152 (1)]	9.10	1321	0.02			
Citronellic acid	9.17	1326	0.14	15.38	2206	0.13
δ-Elemene	9.29	1334	0.02	6.56	1434	0.02
α-Longipinene	9.36	1340	0.03	6.37	1420	0.04
Citronellyl acetate	9.58	1355	1.75	9.06	1628	1.61
Unknown [m/z 43, 95 (53), 121 (47), 107 (38), 93 (36), 41 (35), 67 (31)...]	9.72	1365	0.05			
Unknown [m/z 69, 43 (79), 93 (68), 41 (66), 111 (43), 55 (41), 68 (37)...]	9.79	1370	0.01			

Geranyl acetate	9.99	1385	1.37	10.18	1722	1.32
β-Elemene	10.05	1389	0.04	8.01*	1545	[0.08]
Ethyl decanoate	10.15	1396	0.05	8.82	1609	0.06
β-Caryophyllene	10.38	1412	0.04	8.01*	1545	[0.08]
β-Copaene	10.52	1423	0.01	7.90	1536	0.02
Unknown [m/z 135, 91 (47), 93 (41), 107 (36), 43 (31), 77 (26), 137 (25)... 168 (3)]	10.60	1429	0.03			
trans-α-Bergamotene	10.66	1434	0.02	7.96	1541	0.01
Unknown [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	10.74	1440	0.04	8.42	1577	0.01
α-Humulene	10.84	1446	0.08	8.89*	1614	[0.06]
(*E*)-β-Farnesene	10.99	1458	0.03	9.13*	1634	[0.12]
γ-Muurolene	11.22	1475	0.07	9.21*	1641	0.07
Unknown [m/z 79, 107 (99), 91 (88), 93 (86), 81 (78), 105 (73), 41 (73)... 204? (12)]	11.34	1484	0.02	9.33	1650	0.05
δ-Selinene	11.36	1486	0.02	9.21*	1641	[0.07]
Methyl (*E*)-isoeugenol	11.41	1489	0.03			
(*Z*)-α-Bisabolene	11.58	1502	0.02	9.94*	1701	[0.04]
γ-Cadinene	11.67	1509	0.10	9.97*	1704	0.08
δ-Cadinene	11.80	1520	0.09	9.97*	1704	[0.08]
(*E*)-α-Bisabolene	12.09	1542	0.02	10.33*	1734	[0.68]
Caryophyllene oxide	12.49	1574	0.02			
Selin-6-en-4α-ol isomer	12.96	1610	0.10	14.35	2103	0.09
Cubenol	13.26*	1636	0.04	13.23	1994	0.01
τ-Cadinol	13.26*	1636	[0.04]	14.44	2111	0.01
τ-Muurolol	13.26*	1636	[0.04]	14.54*	2121	[0.01]
β-Eudesmol	13.33	1641	0.02	14.94	2162	0.02
(2*E*,6*E*)-Farnesol	14.28	1721	0.04	16.42	2316	0.05
Unknown [m/z 107, 109 (64), 81 (61), 91 (51), 41 (49), 93 (47), 69 (41)...]	15.56	1834	0.01			
(2*E*,6*E*)-Farnesyl acetate	15.77	1852	0.01			
Cembrene?	16.52	1921	0.01	14.61	2129	0.03
Thunbergol?	17.79	2043	0.01	18.15	2508	0.01
(*Z*)-Abienol	18.69	2134	0.02	19.89	2714	0.01
Total identified		**97.81%**			**97.98%**	

Total reported	**98.31%**	**98.14%**

*: 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

628 Boulevard du Saguenay, Saguenay (Qc) G7J 1H4 | www.phytochemia.com