

Date : October 22, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21J08-PTH02

Customer identification : Geranium Egyptian - Egypt - G30108208R

Type : Essential oil

Source : *Pelargonium x asperum* ct. Egyptian

Customer : Plant Therapy

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 : Seydou Ka, Ph. D.

Analysis date : October 13, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid

Refractive index: 1.4669 ± 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
Isobutyral	tr	Aliphatic aldehyde
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.02	Aliphatic alcohol
3-Methylpentanol	0.04	Aliphatic alcohol
(3Z)-Hexenol	0.02	Aliphatic alcohol
3-Acetyl-3-methylcyclopentene	0.01	Aliphatic ketone
3-Methylpentyl formate?	0.01	Aliphatic ester
α -Thujene	0.01	Monoterpene
α -Pinene	0.53	Monoterpene
Unknown	0.03	Unknown
Geranic oxide	0.07	Monoterpenic ether
Octen-3-ol	0.02	Aliphatic alcohol
6-Methyl-5-hepten-2-one	0.09	Aliphatic ketone
<i>trans</i> -Dehydroxylinalool oxide	0.04	Monoterpenic ether
Myrcene	0.10	Monoterpene
α -Phellandrene	0.09	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.03	Monoterpenic ether
α -Terpinene	0.02	Monoterpene
para-Cymene	0.09	Monoterpene
Unknown	0.03	Unknown
Unknown	0.03	Unknown
Limonene	0.14	Monoterpene
β -Phellandrene	0.07	Monoterpene
Benzeneacetaldehyde	0.16	Simple phenolic
(Z)- β -Ocimene	0.08	Monoterpene
(E)- β -Ocimene	0.12	Monoterpene
Unknown	0.02	Unknown
2,6-Dimethyl-5-heptenal (melonal)	0.02	Aliphatic aldehyde
γ -Terpinene	0.04	Monoterpene
<i>cis</i> -Sabinene hydrate	0.02	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.20	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
Fenchone	0.03	Monoterpenic ketone
Terpinolene	0.03	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	0.08	Monoterpenic alcohol
<i>trans</i> -Sabinene hydrate	0.05	Monoterpenic alcohol
Linalool	4.14	Monoterpenic alcohol
Phenylethyl alcohol	0.08	Simple phenolic
<i>cis</i> -Rose oxide	1.02	Monoterpenic ether
<i>trans</i> -Rose oxide	0.45	Monoterpenic ether
Unknown	0.04	Unknown
neo-Isopulegol	0.08	Monoterpenic alcohol
Menthone	1.35	Monoterpenic ketone
Citronellal	0.05	Monoterpenic aldehyde

iso-Isopulegol	0.09	Monoterpenic alcohol
Isomenthone	5.37	Monoterpenic ketone
Borneol	0.08	Monoterpenic alcohol
neo-Menthol	0.10	Monoterpenic alcohol
Terpinen-4-ol	0.16	Monoterpenic alcohol
Menthol	0.06	Monoterpenic alcohol
Isomenthol	0.20	Monoterpenic alcohol
para-Cyemen-8-ol	0.06	Monoterpenic alcohol
α -Terpineol	0.34	Monoterpenic alcohol
Unknown	0.03	Unknown
Unknown	0.03	Oxygenated monoterpene
β -Cyclocitral	0.02	Monoterpenic aldehyde
Nerol	0.29	Monoterpenic alcohol
Citronellol	32.92	Monoterpenic alcohol
Neral	0.27	Monoterpenic aldehyde
Piperitone	0.14	Monoterpenic ketone
Geraniol	14.49	Monoterpenic alcohol
Geranial	0.59	Monoterpenic aldehyde
Citronellyl formate	6.81	Monoterpenic ester
Neryl formate	0.30	Monoterpenic ester
Geranyl formate	2.67	Monoterpenic ester
Methyl geranate	0.03	Monoterpenic ester
Citronellic acid	0.05	Monoterpenic acid
α -Cubebene	0.20	Sesquiterpene
Phenylethyl propionate	0.03	Phenolic ester
Citronellyl acetate	0.26	Monoterpenic ester
Geranic acid	0.16	Aliphatic acid
α -Copaene	0.49	Sesquiterpene
β -Bourbonene	1.13	Sesquiterpene
1,5-diepi- β -Bourbonene	0.04	Sesquiterpene
Geranyl acetate	0.40	Monoterpenic ester
β -Elemene	0.09	Sesquiterpene
Isocaryophyllene	0.07	Sesquiterpene
β -Caryophyllene	1.28	Sesquiterpene
β -Copaene	0.16	Sesquiterpene
Heptyl tiglate	0.03	Aliphatic ester
6,9-Guaiadiene	0.39	Sesquiterpene
Isogermacrene D	0.47	Sesquiterpene
α -Humulene	0.02	Sesquiterpene
Unknown	0.36	Sesquiterpene
Citronellyl propionate	0.42	Monoterpenic ester
allo-Aromadendrene	0.18	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.25	Sesquiterpene
γ -Murolene	0.11	Sesquiterpene
α -Amorphene	0.07	Sesquiterpene
Germacrene D	1.51	Sesquiterpene
Geranyl propionate	0.77	Monoterpenic ester
β -Selinene	0.16	Sesquiterpene
Phenylethyl isovalerate	0.16	Phenolic ester
γ -Amorphene	0.06	Sesquiterpene
Bicyclogermacrene	0.77	Sesquiterpene
Viridiflorene	0.02	Sesquiterpene

4-epi- <i>cis</i> -Dihydroagarofuran	0.07	Sesquiterpenic ether
α -Muurolene	0.30	Sesquiterpene
γ -Cadinene	0.42	Sesquiterpene
7-epi- α -Selinene	0.07	Sesquiterpene
δ -Cadinene	0.47	Sesquiterpene
<i>trans</i> -Calamenene	0.02	Sesquiterpene
Geranyl isobutyrate	0.30	Monoterpenic ester
<i>trans</i> -Cadina-1,4-diene	0.15	Sesquiterpene
Citronellyl butyrate	0.56	Monoterpenic ester
α -Agarofuran	0.32	Sesquiterpenic ether
Geranyl butyrate	0.84	Monoterpenic ester
Spathulenol	0.16	Sesquiterpenic alcohol
Caryophyllene oxide	0.16	Sesquiterpenic ether
Globulol	0.08	Sesquiterpenic alcohol
Phenylethyl tiglate	0.78	Phenolic ester
Viridiflorol	0.06	Sesquiterpenic alcohol
Geranyl 2-methylbutyrate?	0.07	Monoterpenic ester
Geranyl isovalerate	0.07	Monoterpenic ester
10-epi- γ -Eudesmol	4.44	Sesquiterpenic alcohol
1-epi-Cubenol	0.14	Sesquiterpenic alcohol
Unknown	0.18	Oxygenated sesquiterpene
γ -Eudesmol	0.17	Sesquiterpenic alcohol
Citronellyl valerate?	0.05	Monoterpenic ester
τ -Muurolol	0.12	Sesquiterpenic alcohol
τ -Cadinol	0.03	Sesquiterpenic alcohol
Cubenol	0.14	Sesquiterpenic alcohol
β -Eudesmol	0.23	Sesquiterpenic alcohol
α -Eudesmol	0.24	Sesquiterpenic alcohol
α -Cadinol	0.08	Sesquiterpenic alcohol
<i>cis</i> -Calamenen-10-ol	0.02	Sesquiterpenic alcohol
Geranyl valerate	0.15	Monoterpenic ester
Citronellyl tiglate	0.26	Monoterpenic ester
Citronellyl 4-methylvalerate	0.09	Monoterpenic ester
Geranyl tiglate	1.05	Monoterpenic ester
Geranyl 4-methylvalerate?	0.16	Monoterpenic ester
Citronellyl caproate	0.05	Monoterpenic ester
Geranyl caproate	0.17	Monoterpenic ester
Citronellyl heptanoate	0.06	Monoterpenic ester
Phytone	0.03	Terpenic ketone
Geranyl heptanoate	0.10	Monoterpenic ester
Unknown	0.02	Unknown
Geranyl caprylate	0.04	Monoterpenic ester
Consolidated total	97.61%	

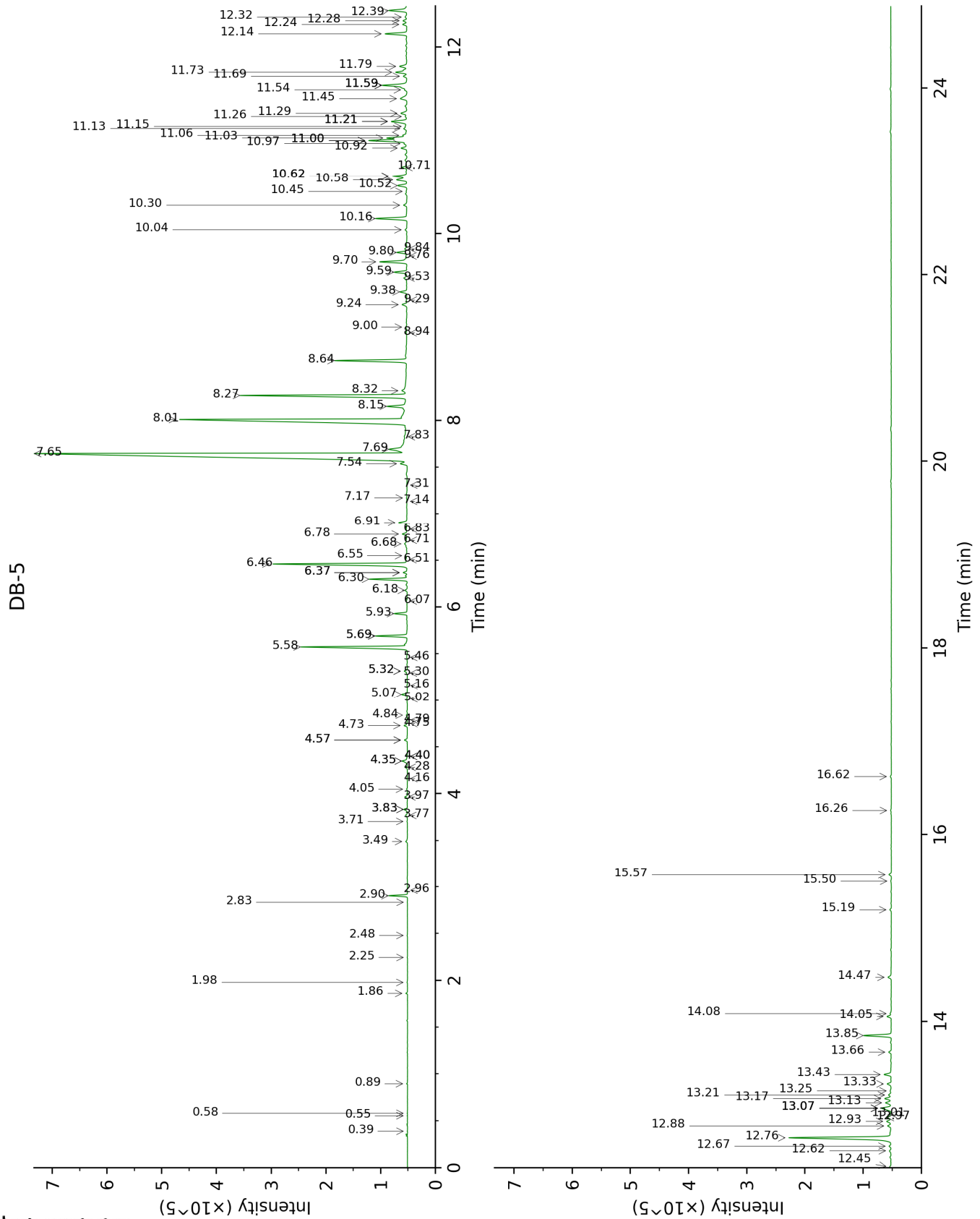
tr: The compound has been detected below 0.005% of total signal.

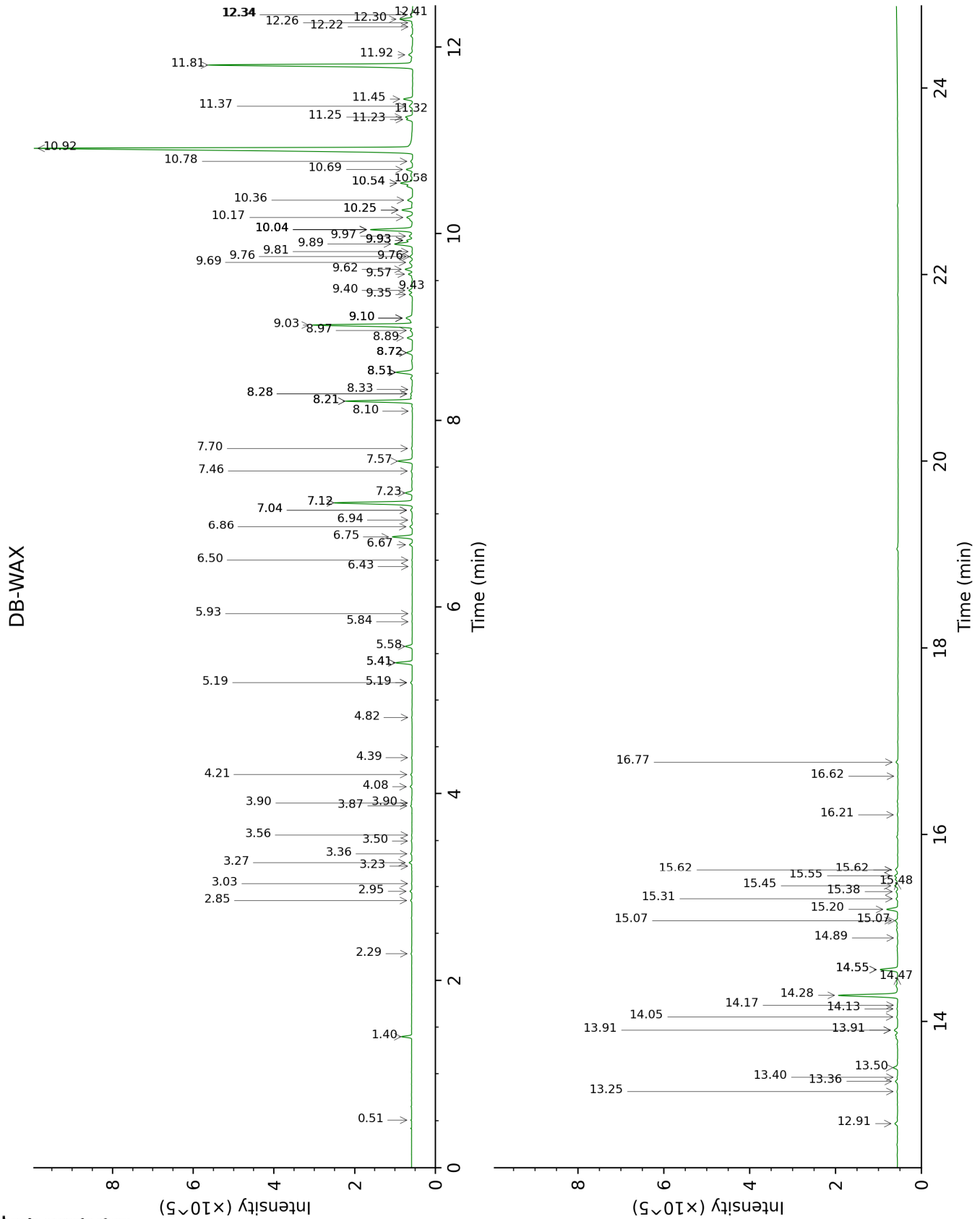
Note: no correction factor was applied

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	%
Isobutyral	0.39	537	tr	0.51	778	0.02
Isovaleral	0.55	641	tr			
2-Methylbutyral	0.58	651	0.01			
Isoamyl alcohol	0.89	731	0.02	3.56	1179	0.02
3-Methylpentanol	1.86	847	0.04	5.19*	1296	0.09
(3Z)-Hexenol	1.98	857	0.02	5.93	1348	0.03
3-Acetyl-3-methylcyclopentene	2.25	880	0.01			
3-Methylpentyl formate?	2.48	900	0.01	3.23	1153	0.01
α-Thujene	2.84	925	0.01			
α-Pinene	2.90	930	0.53	1.40	988	0.52
Unknown [m/z 122, 107 (38), 121 (35), 79 (28), 77 (27), 43 (26)...]	2.96	934	0.03			
Geranic oxide	3.49	969	0.07	2.29	1076	0.05
Octen-3-ol	3.70	983	0.02	6.94	1421	0.08
6-Methyl-5-hepten-2-one	3.77	988	0.09	5.19*	1296	[0.09]
<i>trans</i> -Dehydroxylinalool oxide	3.83*	992	0.15	3.50	1174	0.04
Myrcene	3.83*	992	[0.15]	2.95	1131	0.10
α-Phellandrene	3.97	1001	0.09	2.85	1124	0.07
<i>cis</i> -Dehydroxylinalool oxide	4.05	1006	0.03	3.90*	1206	0.05
α-Terpinene	4.16	1014	0.02	3.03	1138	0.02
<i>para</i> -Cymene	4.28	1021	0.09	4.21	1228	0.08
Unknown [m/z 59, 43 (12), 109 (11), 41 (10), 127 (8)...]	4.35*†	1025	0.30	6.50	1389	0.03
Unknown [m/z 59, 43 (11), 109 (10), 41 (10), 127 (8)...]	4.35*†	1025	[0.30]	6.43	1384	0.03
Limonene	4.40*†	1028	[0.30]	3.26	1156	0.14
β-Phellandrene	4.40*†	1028	[0.30]	3.36	1164	0.07
Benzeneacetaldehyde	4.57*	1039	0.09	8.97	1574	0.16
(Z)-β-Ocimene	4.57*	1039	[0.09]	3.87	1203	0.08
(E)-β-Ocimene	4.73	1049	0.12	4.08	1218	0.10
Unknown [m/z 125, 69 (75), 41 (34), 55 (25), 93 (22)... 140 (3)]	4.75	1051	0.02	4.82	1273	0.02
2,6-Dimethyl-5-heptenal (melonal)	4.79	1053	0.02	5.41*	1311	1.04
γ-Terpinene	4.84	1056	0.04	3.90*	1206	[0.05]
<i>cis</i> -Sabinene hydrate	5.02	1067	0.02	7.04*	1429	0.14
<i>cis</i> -Linalool oxide (fur.)	5.07	1070	0.20	6.67	1401	0.19

Octanol	5.16	1076	0.02	8.33	1526	0.11
Fenchone	5.30	1085	0.03	5.84	1342	0.02
Terpinolene	5.32*	1086	0.12	4.39	1241	0.03
<i>trans</i> -Linalool oxide (fur.)	5.32*	1086	[0.12]	7.04*	1429	[0.14]
<i>trans</i> -Sabinene hydrate	5.46	1096	0.05	8.10	1508	0.03
Linalool	5.58	1103	4.14	8.21*	1516	4.12
Phenylethyl alcohol	5.69*	1110	1.11	12.26	1847	0.08
<i>cis</i> -Rose oxide	5.69*	1110	[1.11]	5.41*	1311	[1.04]
<i>trans</i> -Rose oxide	5.93	1125	0.45	5.58	1323	0.44
Unknown [m/z 95, 67 (86), 41 (68), 82 (64), 123 (62)...]	6.06	1134	0.04	7.70	1478	0.06
neo-Isopulegol	6.18	1141	0.08	8.28*	1522	0.14
Menthone	6.30	1149	1.35	6.75	1408	1.34
Citronellal	6.37*	1153	0.14	7.12*	1435	5.42
iso-Isopulegol	6.37*	1153	[0.14]	8.21*	1516	[4.12]
Isomenthone	6.46	1159	5.37	7.12*	1435	[5.42]
Borneol	6.51	1162	0.08	9.93*	1651	0.36
neo-Menthol	6.55	1165	0.10	8.72*	1556	0.47
Terpinen-4-ol	6.68	1173	0.16	8.72*	1556	[0.47]
Menthol	6.71	1176	0.06	9.35	1605	0.22
Isomenthol	6.78	1180	0.20	9.10*	1585	0.75
para-Cymen-8-ol	6.83	1183	0.06			
α-Terpineol	6.91	1188	0.34	9.93*	1651	[0.36]
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.14	1202	0.03			
Unknown [m/z 123, 81 (40), 67 (29), 79 (29), 93 (26), 121 (25), 41 (24), 55 (18), 69 (15)...]	7.17	1205	0.03			
β-Cyclocitral	7.31	1214	0.02	8.72*	1556	[0.47]
Nerol	7.54	1229	0.29	11.23	1758	0.36
Citronellol	7.65†	1236	33.38	10.92	1732	32.92
Neral	7.69†	1240	[33.38]	9.57	1622	0.27
Piperitone	7.83	1248	0.14	10.04*	1660	3.00
Geraniol	8.01†	1261	15.08	11.81	1808	14.49
Geranial	8.15†	1270	[15.08]	10.25*	1677	0.71
Citronellyl formate	8.27	1278	6.81	9.03	1579	6.59
Neryl formate	8.32	1281	0.30	9.62	1626	0.56
Geranyl formate	8.64	1303	2.67	10.04*	1660	[3.00]
Methyl geranate	8.94	1324	0.03	9.93*	1651	[0.36]
Citronellic acid	9.00	1328	0.05	16.21	2221	0.05
α-Cubebene	9.24	1345	0.20	6.86	1416	0.17
Phenylethyl propionate	9.29	1349	0.03	12.22	1843	0.07
Citronellyl acetate	9.38	1355	0.26	9.69	1632	0.26
Geranic acid	9.53	1365	0.16	16.77	2278	0.15

α-Copaene	9.59	1370	0.49	7.23	1443	0.50
β-Bourbonene	9.70	1378	1.13	7.57	1468	1.01
1,5-diepi-β-Bourbonene	9.76	1382	0.04	7.46	1460	0.09
Geranyl acetate	9.80	1385	0.40	10.69	1713	0.45
β-Elemene	9.84	1387	0.09	8.51*	1540	1.27
Isocaryophyllene	10.04	1402	0.07	8.28*	1522	[0.14]
β-Caryophyllene	10.16	1410	1.28	8.51*	1540	[1.27]
β-Copaene	10.30	1421	0.16	8.51*	1540	[1.27]
Heptyl tiglate	10.45	1432	0.03			
6,9-Guaiadiene	10.52	1437	0.39	8.72*	1556	[0.47]
Isogermacrene D	10.58	1441	0.47	9.10*	1585	[0.75]
α-Humulene	10.62*	1444	0.59	9.43	1611	0.02
Unknown [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	10.62*	1444	[0.59]	8.89	1568	0.36
Citronellyl propionate	10.62*	1444	[0.59]	10.36	1685	0.42
allo-Aromadendrene	10.72	1452	0.18	9.10*	1585	[0.75]
<i>trans</i> -Cadina-1(6),4-diene	10.92	1467	0.25	9.40	1608	0.26
γ-Muurolene	10.97	1471	0.11	9.76*	1637	0.18
α-Amorphene	11.00*	1473	1.61	9.76*	1637	[0.18]
Germacrene D	11.00*	1473	[1.61]	9.89	1648	1.51
Geranyl propionate	11.03	1475	0.77	11.44	1776	0.60
β-Selinene	11.06	1477	0.16	10.04*	1660	[3.00]
Phenylethyl isovalerate	11.13	1482	0.16	13.25	1935	0.05
γ-Amorphene	11.15	1484	0.06	9.98	1655	0.25
Bicyclogermacrene	11.21*	1488	0.79	10.25*	1677	[0.71]
Viridiflorene	11.21*	1488	[0.79]	9.81	1641	0.02
4-epi- <i>cis</i> -Dihydroagarofuran	11.26	1492	0.07	10.04*	1660	[3.00]
α-Muurolene	11.29	1495	0.30	10.17	1670	0.61
γ-Cadinene	11.45	1506	0.42	10.54*	1700	0.89
7-epi-α-Selinene	11.54	1514	0.07	10.58	1704	0.04
δ-Cadinene	11.59*	1518	1.29	10.54*	1700	[0.89]
<i>trans</i> -Calamenene	11.59*	1518	[1.29]	11.32	1766	0.02
Geranyl isobutyrate	11.59*	1518	[1.29]	11.37	1770	0.30
<i>trans</i> -Cadina-1,4-diene	11.69	1525	0.15	10.78	1721	0.15
Citronellyl butyrate	11.73	1528	0.56	11.25	1760	0.46
α-Agarofuran	11.79	1533	0.32	11.92	1817	0.39
Geranyl butyrate	12.14	1561	0.84	12.30	1850	0.89
Spathulenol	12.24	1568	0.16	14.55*	2057	1.27
Caryophyllene oxide	12.28	1572	0.16	12.91	1904	0.21
Globulol	12.32	1575	0.08	14.13	2017	0.05
Phenylethyl tiglate	12.39	1580	0.78	15.20	2119	0.79
Viridiflorol	12.45	1585	0.06	14.17	2021	0.04
Geranyl 2-methylbutyrate?	12.62	1598	0.07	12.34*	1854	0.18
Geranyl isovalerate	12.67	1602	0.07	12.34*	1854	[0.18]

10-epi- γ -Eudesmol	12.76	1609	4.44	14.28	2031	4.22
1-epi-Cubenol	12.88	1620	0.14	13.91*	1996	0.27
Unknown [m/z 147, 162 (79), 43 (64), 59 (64), 95 (47), 91 (44), 105 (43)... 238 (13)]	12.93	1624	0.18	15.45	2144	0.23
γ -Eudesmol	12.97	1627	0.17	15.08*	2108	0.20
Citronellyl valerate?	13.01	1630	0.05	12.41	1860	0.03
τ -Muurolol	13.07*	1635	0.50	15.31	2131	0.12
τ -Cadinol	13.07*	1635	[0.50]	15.08*	2108	[0.20]
Cubenol	13.07*	1635	[0.50]	13.91*	1996	[0.27]
β -Eudesmol	13.13	1640	0.23	15.62*	2162	0.24
α -Eudesmol	13.17	1644	0.24	15.55	2155	0.23
α -Cadinol	13.21	1647	0.08	15.62*	2162	[0.24]
<i>cis</i> -Calamene-10-ol	13.25	1650	0.02	16.62	2263	0.02
Geranyl valerate	13.33	1656	0.15	13.36	1945	0.16
Citronellyl tiglate	13.43	1665	0.26	13.50	1958	0.29
Citronellyl 4-methylvalerate	13.66	1684	0.09			
Geranyl tiglate	13.85	1699	1.05	14.55*	2057	[1.27]
Geranyl 4-methylvalerate?	14.05	1717	0.16	14.05	2009	0.07
Citronellyl caproate	14.08	1720	0.05	13.40	1949	0.04
Geranyl caproate	14.47	1753	0.17	14.47	2049	0.03
Citronellyl heptanoate	15.19	1816	0.06			
Phytone	15.50	1844	0.03	14.89	2089	0.02
Geranyl heptanoate	15.57	1850	0.10	15.48	2148	0.02
Unknown [m/z 69, 81 (44), 41 (28), 95 (26), 93 (26), 71 (24)...]	16.26	1914	0.02	15.38	2138	0.13
Geranyl caprylate	16.62	1948	0.04			
Total identified		97.88%			95.15%	
Total reported		98.24%			96.01%	

*: 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