

Date : October 21, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19J18-PTH19-1-CC

Customer identification : Lemongrass - India - L8010694R

Type : Essential oil

Source : *Cymbopogon flexuosus*

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 : October 21, 2019

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: 1.4853 ± 0.0003 (20 °C)

ISO 4718:2004 - OIL OF LEMONGRASS

Compound	Min. %	Max. %	Observed %	Complies?
Geraniol	1.5	8.0	5.3	Yes
Geranyl acetate	0.5	6.0	3.5	Yes
Geranial	35.0	47.0	40.9	Yes
Neral	25.0	35.0	31.9	Yes
β-Caryophyllene	0.2	3.5	1.8	Yes
6-Methyl-5-hepten-2-one	0.1	2.0	1.2	Yes
Limonene	0.5	3.5	0.2	No
Refractive index	1.4830	1.4890	1.4853	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil marginally does not comply with the ISO standard for lemongrass oil.

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Hexanal	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.02	Aliphatic alcohol
4-Heptanone	0.02	Aliphatic ketone
Tricyclene	0.15	Monoterpene
α -Pinene	0.19	Monoterpene
Camphene	1.09	Monoterpene
Sabinene	0.01	Monoterpene
β -Pinene	0.01	Monoterpene
6-Methyl-5-hepten-2-one	1.18	Aliphatic ketone
Myrcene	0.07	Monoterpene
6-Methyl-5-hepten-2-ol	0.07	Aliphatic alcohol
Octanal	0.10	Aliphatic aldehyde
1,8-Cineole	0.04	Monoterpenic ether
Limonene	0.25	Monoterpene
(Z)- β -Ocimene	0.30	Monoterpene
(E)- β -Ocimene	0.19	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.02	Aliphatic aldehyde
γ -Terpinene	0.01	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.02	Monoterpenic alcohol
4-Nonanone	0.77	Aliphatic ketone
Camphenilone	0.02	Normoterpenic ketone
<i>trans</i> -Linalool oxide (fur.)	0.06	Monoterpenic alcohol
Terpinolene	0.01	Monoterpene
4-Nonanol	0.02	Aliphatic alcohol
Rosefuran	0.20	Monoterpenic ether
Perillene	0.08	Monoterpenic ether
Linalool	0.94	Monoterpenic alcohol
<i>cis</i> -Chrysanthemal?	0.03	Monoterpenic aldehyde
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.03	Monoterpenic alcohol
Unknown	0.13	Unknown
Unknown	0.02	Unknown
exo-Isocitral	0.11	Monoterpenic aldehyde
<i>trans</i> -Chrysanthemal	0.25	Monoterpenic aldehyde
Citronellal	0.27	Monoterpenic aldehyde
Borneol	0.21	Monoterpenic alcohol
Isoneral	0.83	Monoterpenic aldehyde
α -Phellandren-8-ol	0.02	Monoterpenic alcohol
Rosefuran oxide	0.21	Monoterpenic ether
Unknown	0.01	Oxygenated monoterpene
Unknown	tr	Unknown
Isogeranial	1.38	Monoterpenic aldehyde
α -Terpineol	0.15	Monoterpenic alcohol
<i>trans</i> -Isopiperitenol	0.07	Monoterpenic alcohol
Unknown	0.05	Oxygenated monoterpene
Decanal	0.15	Aliphatic aldehyde

<i>cis</i> -Isopiperitenol	0.02	Monoterpenic alcohol
2,3-Epoxyneral?	0.03	Monoterpenic aldehyde
Citronellol	0.12	Monoterpenic alcohol
Nerol	0.15	Monoterpenic alcohol
Piperitone	0.04	Monoterpenic ketone
Neral	31.90	Monoterpenic aldehyde
Geraniol	5.33	Monoterpenic alcohol
Geranial	40.87	Monoterpenic aldehyde
Unknown	0.11	Oxygenated monoterpene
Geranyl formate	0.03	Monoterpenic ester
Unknown	0.04	Unknown
α -Cubebene	0.01	Sesquiterpene
Citronellyl acetate	0.06	Monoterpenic ester
Cyclosativene I	0.08	Sesquiterpene
Cyclosativene II	0.13	Sesquiterpene
Geranic acid	0.19	Aliphatic acid
α -Copaene	0.05	Sesquiterpene
β -Bourbonene	0.03	Sesquiterpene
Geranyl acetate	3.51	Monoterpenic ester
β -Cubebene	0.07	Sesquiterpene
β -Elemene	0.04	Sesquiterpene
β -Caryophyllene	1.80	Sesquiterpene
β -Copaene	0.09	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.02	Sesquiterpene
α -Humulene	0.47	Sesquiterpene
(<i>E</i>)-Isoeugenol	0.20	Phenylpropanoid
<i>cis</i> -Muurolo-4(15),5-diene	0.03	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.03	Sesquiterpene
Germacrene D	0.28	Sesquiterpene
γ -Amorphene	0.02	Sesquiterpene
epi-Cubebol	0.14	Sesquiterpenic alcohol
α -Muurolole	0.09	Sesquiterpene
Cubebol	0.24	Sesquiterpenic alcohol
γ -Cadinene	0.87	Sesquiterpene
δ -Cadinene	0.28	Sesquiterpene
(<i>E</i>)- γ -Bisabolene	0.26	Sesquiterpene
α -Elemol	0.08	Sesquiterpenic alcohol
Germacrene B	0.04	Sesquiterpene
Geranyl butyrate	0.06	Monoterpenic ester
Caryophyllene oxide	0.40	Sesquiterpenic ether
Humulene epoxide II	0.03	Sesquiterpenic ether
Selin-6-en-4 α -ol isomer	0.01	Sesquiterpenic alcohol
1-epi-Cubenol	0.03	Sesquiterpenic alcohol
Cubenol	0.03	Sesquiterpenic alcohol
τ -Cadinol	0.02	Sesquiterpenic alcohol
β -Eudesmol	0.01	Sesquiterpenic alcohol
α -Eudesmol	0.01	Sesquiterpenic alcohol
Farnesal isomer	0.02	Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i>)-Farnesal	0.02	Sesquiterpenic aldehyde
Neophytadiene	0.03	Diterpene
meta-Camphorene	0.01	Diterpene
Palmitic acid	0.01	Aliphatic acid

Unknown	0.03	Unknown
Dicitral	0.04	Diterpenic aldehyde
Phytol	0.01	Diterpenic alcohol
Unknown	0.05	Unknown
Phytol isomer	0.01	Diterpenic alcohol
Unknown	0.04	Unknown
Unknown	0.01	Unknown
Unknown	0.02	Unknown
Consolidated total	98.38%	

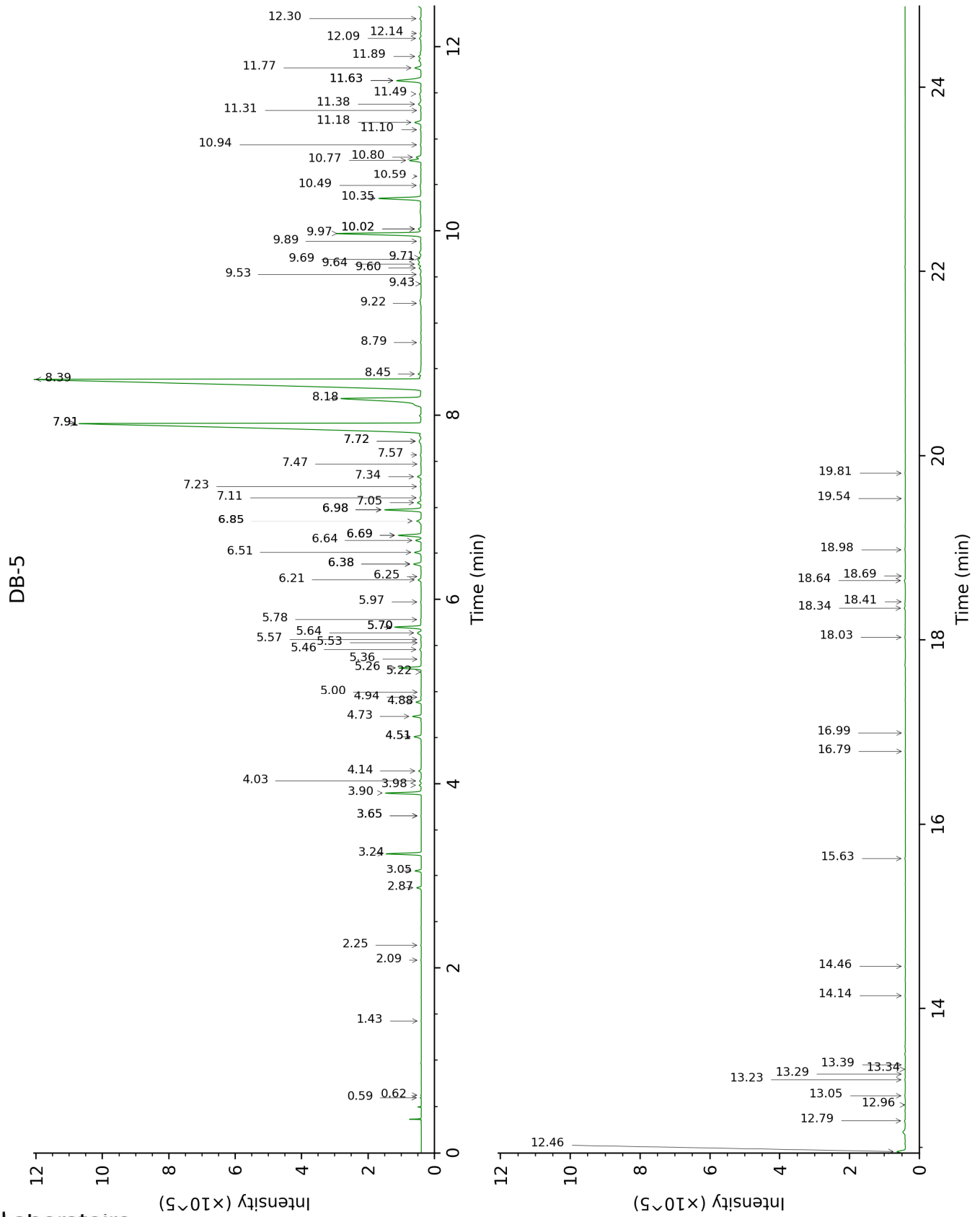
tr: The compound has been detected below 0.005% of total signal.

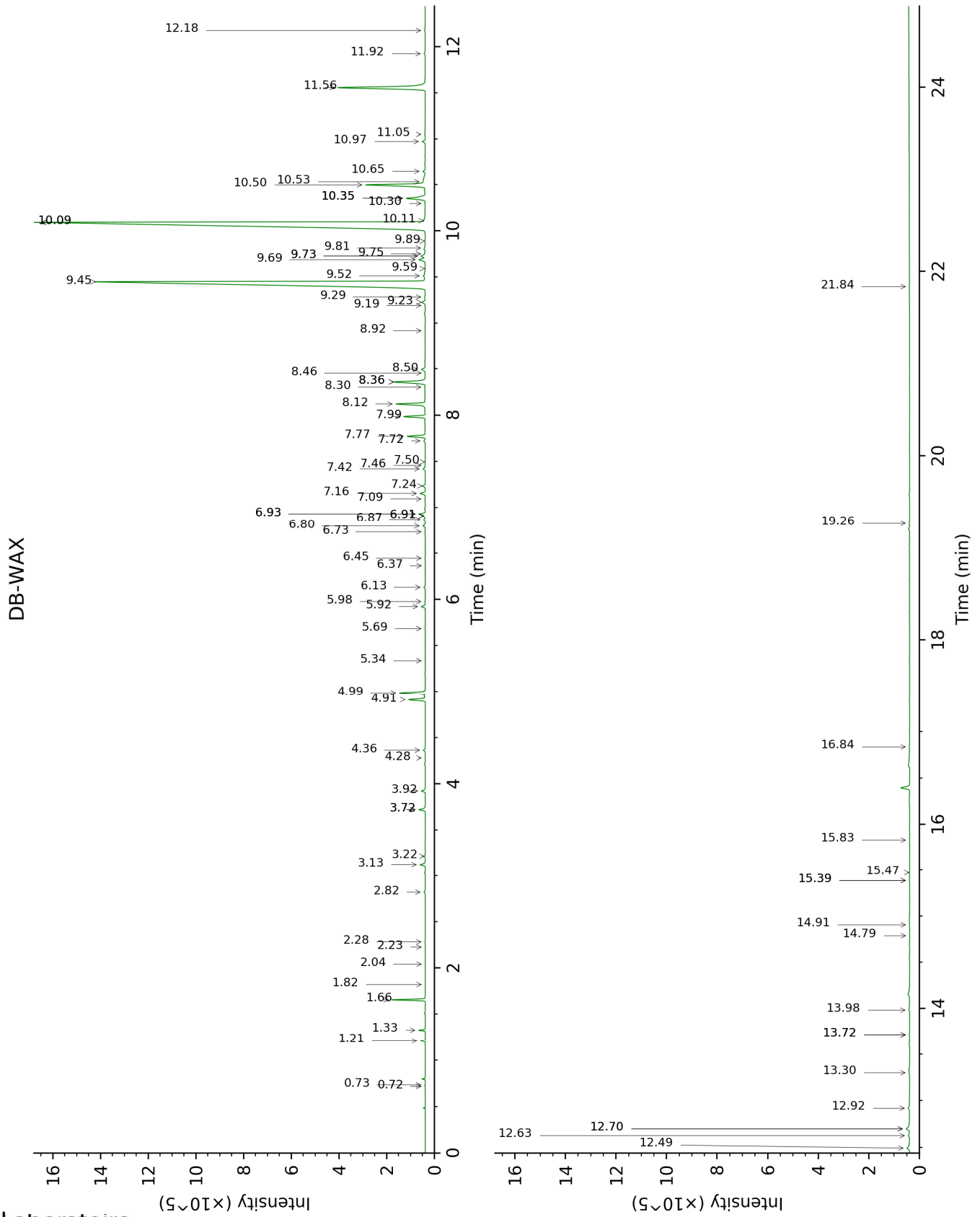
Note: no correction factor was applied

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	%
Isovaleral	0.60	641	0.01	0.73	883	0.01
2-Methylbutyral	0.62	651	0.01	0.72	877	tr
Hexanal	1.43	799	0.01	1.82	1042	0.01
(3Z)-Hexenol	2.09	856	0.02	5.69	1343	0.02
4-Heptanone	2.25	869	0.02	2.28	1087	0.02
Tricyclene	2.87	917	0.15	1.21	970	0.13
α-Pinene	3.05	929	0.19	1.33	989	0.19
Camphene	3.24	941	1.09	1.66	1026	1.08
Sabinene	3.65*	968	0.02	2.23	1081	0.01
β-Pinene	3.65*	968	[0.02]	2.04	1063	0.01
6-Methyl-5-hepten-2-one	3.90	985	1.18	4.99	1292	1.17
Myrcene	3.98	990	0.07	2.82	1131	0.07
6-Methyl-5-hepten-2-ol	4.03	993	0.07	6.91*	1432	0.07
Octanal	4.14	1000	0.10	4.36	1247	0.09
1,8-Cineole	4.51*	1024	0.27	3.22	1162	0.04
Limonene	4.51*	1024	[0.27]	3.13	1155	0.25
(Z)-β-Ocimene	4.73	1038	0.30	3.72*	1201	0.31
(E)-β-Ocimene	4.88	1048	0.19	3.92	1215	0.19
2,6-Dimethyl-5-heptenal (melonal)	4.94	1051	0.02	5.34	1318	0.01
γ-Terpinene	5.00	1055	0.01	3.72*	1201	[0.31]
cis-Linalool oxide (fur.)	5.22	1069	0.02	6.45	1399	0.02
4-Nonanone	5.26	1072	0.77	4.91	1287	0.76
Camphenilone	5.36	1078	0.02	6.36	1393	0.01
trans-Linalool oxide (fur.)	5.46	1084	0.06	6.87	1429	0.08
Terpinolene	5.53	1089	0.01	4.28	1241	0.02
4-Nonanol	5.57	1091	0.02			
Rosefuran	5.64	1096	0.20	5.92	1361	0.20
Perillene	5.70*	1100	1.00	6.13	1376	0.08
Linalool	5.70*	1100	[1.00]	7.99	1512	0.94
cis-Chrysanthemal?	5.78	1105	0.03	5.98	1365	0.03
trans-para-Mentha-2,8-dien-1-ol	5.97	1117	0.03	8.92	1584	0.02
Unknown [m/z 81, 70 (98), 67 (63), 82 (53), 41 (46), 69 (46), 109 (43)...]	6.21	1133	0.13	6.80	1424	0.13
Unknown [m/z 95, 67 (86), 41 (68), 82 (64),	6.25	1135	0.02	7.46	1473	0.02

123 (62)...						
exo-Isocitral	6.38*	1144	0.32	7.42	1470	0.11
<i>trans</i> - Chrysanthemal	6.38*	1144	[0.32]	7.16	1450	0.25
Citronellal	6.51	1152	0.27	6.93*	1434	0.29
Borneol	6.64	1161	0.21	9.73*	1649	0.24
Isoneral	6.69*	1164	0.85	7.77	1496	0.83
α -Phellandren- 8-ol	6.69*	1164	[0.85]	10.09*	1678	40.98
Rosefuran oxide	6.85*	1175	0.28	8.50	1552	0.21
Unknown [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)]	6.85*	1175	[0.28]	9.59	1638	0.01
Unknown [m/z 69, 41 (65), 109 (36), 67 (16), 84 (11), 43 (10), 55 (9)...	6.98*	1183	1.36			
Isogeranial	6.98*	1183	[1.36]	8.12	1523	1.38
α -Terpineol	7.06	1188	0.15	9.69	1646	0.36
<i>trans</i> - Isopiperitenol	7.11	1192	0.07	10.35*	1699	1.19
Unknown [m/z 84, 41 (83), 83 (79), 91 (76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)]	7.23	1200	0.05			
Decanal	7.34	1207	0.15	7.24	1456	0.14
<i>cis</i> - Isopiperitenol	7.47	1216	0.02	10.30	1695	0.02
2,3-Epoxyneral?	7.57	1223	0.03			
Citronellol	7.72*	1234	0.15	10.65	1724	0.12
Nerol	7.72*	1234	[0.15]	10.97	1752	0.15
Piperitone	7.91*	1247	31.94	9.82	1656	0.04
Neral	7.91*	1247	[31.94]	9.45	1626	31.90
Geraniol	8.18	1264	5.33	11.56	1801	5.51
Geranial	8.39	1278	40.87	10.09*	1678	[40.98]
Unknown [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)]	8.45	1282	0.11	12.92	1922	0.12
Geranyl formate	8.79	1305	0.03	9.89	1662	0.02
Unknown [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)...	9.22	1334	0.04	12.63	1896	0.11
α -Cubebene	9.43	1349	0.01	6.73	1419	0.02

Citronellyl acetate	9.53	1356	0.06	9.52	1632	0.10
Cyclosativene I	9.60	1361	0.08	6.91*	1432	[0.07]
Cyclosativene II	9.64	1364	0.13	6.93*	1434	[0.29]
Geranic acid	9.69	1367	0.19			
α-Copaene	9.71	1369	0.05	7.10	1446	0.03
β-Bourbonene	9.89	1381	0.03	7.50	1476	0.01
Geranyl acetate	9.97	1387	3.51	10.50	1712	3.24
β-Cubebene	10.02*	1390	0.11	7.72	1492	0.07
β-Elemene	10.02*	1390	[0.11]	8.36*	1541	1.80
β-Caryophyllene	10.35	1414	1.80	8.36*	1541	[1.80]
β-Copaene	10.49	1424	0.09	8.30	1537	0.04
<i>trans</i> -α-Bergamotene	10.59	1432	0.02	8.46	1548	0.01
α-Humulene	10.77	1445	0.47	9.23	1609	0.18
(<i>E</i>)-Isoeugenol	10.80	1447	0.20			
<i>cis</i> -Muurolo-4(15),5-diene	10.94	1457	0.03	9.29	1613	0.05
<i>trans</i> -Cadina-1(6),4-diene	11.10	1469	0.03	9.19	1606	0.02
Germacrene D	11.18	1475	0.28	9.73*	1649	[0.24]
γ-Amorphene	11.31	1485	0.02	9.75	1651	0.03
epi-Cubebol	11.38	1490	0.14	11.92	1834	0.08
α-Muurolole	11.49	1498	0.09	10.11	1680	0.11
Cubebol	11.63*	1509	1.26	12.49	1884	0.24
γ-Cadinene	11.63*	1509	[1.26]	10.35*	1699	[1.19]
δ-Cadinene	11.77	1519	0.28	10.53	1714	0.22
(<i>E</i>)-γ-Bisabolene	11.89	1529	0.26	10.35*	1699	[1.19]
α-Elemol	12.09	1544	0.08	13.98	2021	0.07
Germacrene B	12.14	1548	0.04	11.05	1758	0.05
Geranyl butyrate	12.30	1561	0.06	12.18	1856	0.06
Caryophyllene oxide	12.46	1573	0.40	12.70*	1902	0.30
Humulene epoxide II	12.78	1599	0.03	13.30	1958	0.04
Selin-6-en-4α-ol isomer	12.96	1612	0.01	14.79	2099	0.01
1-epi-Cubebol	13.05	1620	0.03	13.72*	1996	0.04
Cubebol	13.23	1635	0.03	13.72*	1996	[0.04]
τ-Cadinol	13.29	1640	0.02	14.91	2111	0.01
β-Eudesmol	13.34	1644	0.01	15.39*	2159	0.03
α-Eudesmol	13.39	1648	0.01	15.39*	2159	[0.03]
Farnesal isomer	14.14	1710	0.02			
(2 <i>E</i> ,6 <i>E</i>)-Farnesal	14.46	1738	0.02	15.83	2203	0.02
Neophytadiene	15.63	1841	0.03	12.70*	1902	[0.30]
meta-Camphorene	16.79	1949	0.01	15.47	2167	0.02
Palmitic acid	16.99	1968	0.01	21.84	2899	0.01
Unknown [m/z 93, 69 (95), 135]	18.03	2070	0.03			

(76), 107 (53), 41 (53), 109 (50)... 235 (10)...						
Dicital	18.34	2102	0.04	16.84	2309	0.04
Phytol	18.41	2109	0.01	19.26	2580	0.03
Unknown [m/z 69, 41 (38), 151 (36), 123 (34), 82 (24), 43 (23), 109 (21)...	18.64	2133	0.05			
Phytol isomer	18.69	2138	0.01			
Unknown [m/z 94, 43 (85), 93 (81), 69 (76), 137 (76), 95 (60), 134 (51)...	18.98	2168	0.04			
Unknown [m/z 94, 43 (56), 123 (55), 69 (53), 95 (42), 79 (39)...	19.54	2227	0.01			
Unknown [m/z 123, 94 (100), 43 (86), 69 (75), 95 (47), 41 (47), 93 (45)...	19.81	2257	0.02			
Total identified		97.89%			96.55%	
Total reported		98.38%			96.94%	

*: 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