

Date : 2023-08-08

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 23G20-NPA04

Customer Identification : Bergamot - Citrus bergamia - Italy - NPS00087 - Lot # NP0178

Type : Essential Oil

Source : Citrus aurantium var. bergamia

Customer : Nature Packaged

Checked and approved by:



Alexis St-Gelais, Ph. D., Chimiste 2013-174

Notes: 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.

This report is an update from the first version issued on 2023-08-03 to format it for online publication.

Essential Oil, *Citrus aurantium* var. bergamia
Internal code: 23G20-NPA04

Bergamot - *Citrus bergamia* - Italy - NPS00087 - Lot # NP0178

Report prepared for:
Nature Packaged

GAS CHROMATOGRAPHIC ANALYSIS

Method : PC-MAT-014 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID



Results : See analysis summary (next page)

Analyst : Sylvain Mercier, M. Sc., Chimiste 2014-005

Date : 2023-08-01

PHYSICOCHEMICAL DATA

Refractive index : 1.4651 ± 0.0003 (20 °C)

Method : PC-MAT-016 - Measure of the refractive index of a liquid.

Analyst : Cindy Caron B. Sc.

Date : 2023-07-20

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
Tricyclene	tr	Monoterpene
α-Thujene	0.23	Monoterpene
α-Pinene	1.01	Monoterpene
Camphene	0.03	Monoterpene
α-Fenchene	tr	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
Sabinene	0.94	Monoterpene
β-Pinene	5.90	Monoterpene
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
Myrcene	0.90	Monoterpene
α-Phellandrene	0.02	Monoterpene
Pseudolimonene	tr	Monoterpene
Octanal	0.01	Aliphatic aldehyde
Δ3-Carene	0.01	Monoterpene
α-Terpinene	0.11	Monoterpene
para-Cymene	0.26	Monoterpene
1,8-Cineole	0.01	Monoterpenic ether
β-Phellandrene	0.17	Monoterpene
Limonene	37.68	Monoterpene
(Z)-β-Ocimene	0.04	Monoterpene
(E)-β-Ocimene	0.11	Monoterpene
γ-Terpinene	6.77	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.04	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
trans-Linalool oxide (fur.)	0.04	Monoterpenic alcohol
Terpinolene	0.22	Monoterpene
Nonanal	0.01	Aliphatic aldehyde
Linalool	14.89	Monoterpenic alcohol
cis-Limonene oxide	0.01	Monoterpenic ether
trans-Limonene oxide	0.01	Monoterpenic ether
Camphor	0.01	Monoterpenic ketone
Epoxyterpinolene	0.01	Monoterpenic ether
Citronellal	0.01	Monoterpenic aldehyde
Terpinen-4-ol	0.02	Monoterpenic alcohol
α-Terpineol	0.03	Monoterpenic alcohol
Hodiendiol (2,6-dimethylocta-3,7-diene-2,6-diol)	0.01	Monoterpenic alcohol
Unknown	tr	Unknown
Decanal	0.02	Aliphatic aldehyde

Octyl acetate	0.03	Aliphatic ester
Nerol	0.01	Monoterpenic alcohol
Neral	0.20	Monoterpenic aldehyde
Geraniol	0.01	Monoterpenic alcohol
Linalyl acetate	26.41	Monoterpenic ester
(<i>trans</i> ?)-Linalool oxide acetate (fur.)?	0.07	Monoterpenic ester
Geranial	0.29	Monoterpenic aldehyde
Bornyl acetate	0.01	Monoterpenic ester
Unknown	0.01	Unknown
<i>cis</i> - <i>para</i> -Mentha-2,8-diene-1-hydroperoxide	0.01	Monoterpenic peroxide
<i>trans</i> - <i>para</i> -Mentha-2,8-diene-1-hydroperoxide	tr	Monoterpenic peroxide
Linalyl propionate	0.01	Monoterpenic ester
Hodiendiol derivative	0.03	Oxygenated monoterpane
α -Terpinyl acetate	0.04	Monoterpenic ester
Unknown	0.02	Monoterpenic ester
Citronellyl acetate	0.01	Monoterpenic ester
Unknown	0.02	Oxygenated monoterpane
Neryl acetate	0.43	Monoterpenic ester
Geranyl acetate	0.44	Monoterpenic ester
β -Elemene	0.01	Sesquiterpene
Dodecanal	0.01	Aliphatic aldehyde
<i>cis</i> - α -Bergamotene	0.03	Sesquiterpene
β -Caryophyllene	0.15	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.22	Sesquiterpene
α -Humulene	0.01	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.03	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
Hodiendiol derivative II	0.01	Oxygenated monoterpane
(<i>Z</i>)- α -Bisabolene	tr	Sesquiterpene
β -Bisabolene	0.62	Sesquiterpene
γ -Cadinene	0.01	Sesquiterpene
δ -Cadinene	0.01	Sesquiterpene
β -Sesquiphellandrene	0.02	Sesquiterpene
(<i>E</i>)- α -Bisabolene	0.01	Sesquiterpene
(<i>E</i>)-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.01	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
α -Bisabolol	0.01	Sesquiterpenic alcohol
Nootkatone	0.01	Sesquiterpenic ketone
<i>meta</i> -Camphorene	tr	Diterpene
Citropten	0.03	Furanocoumarin
Palmitic acid	0.03	Aliphatic acid
Bergapten	0.02	Furanocoumarin
Linoleic acid	0.02	Aliphatic acid

Essential Oil, *Citrus aurantium* var. bergamia
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Bergamot - *Citrus bergamia* - Italy - NPS00087 - Lot # NP0178

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Oleic acid	tr	Aliphatic acid
Stearic acid	0.14	Aliphatic acid
Consolidated total	99.06	

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

Note: no correction factor was applied

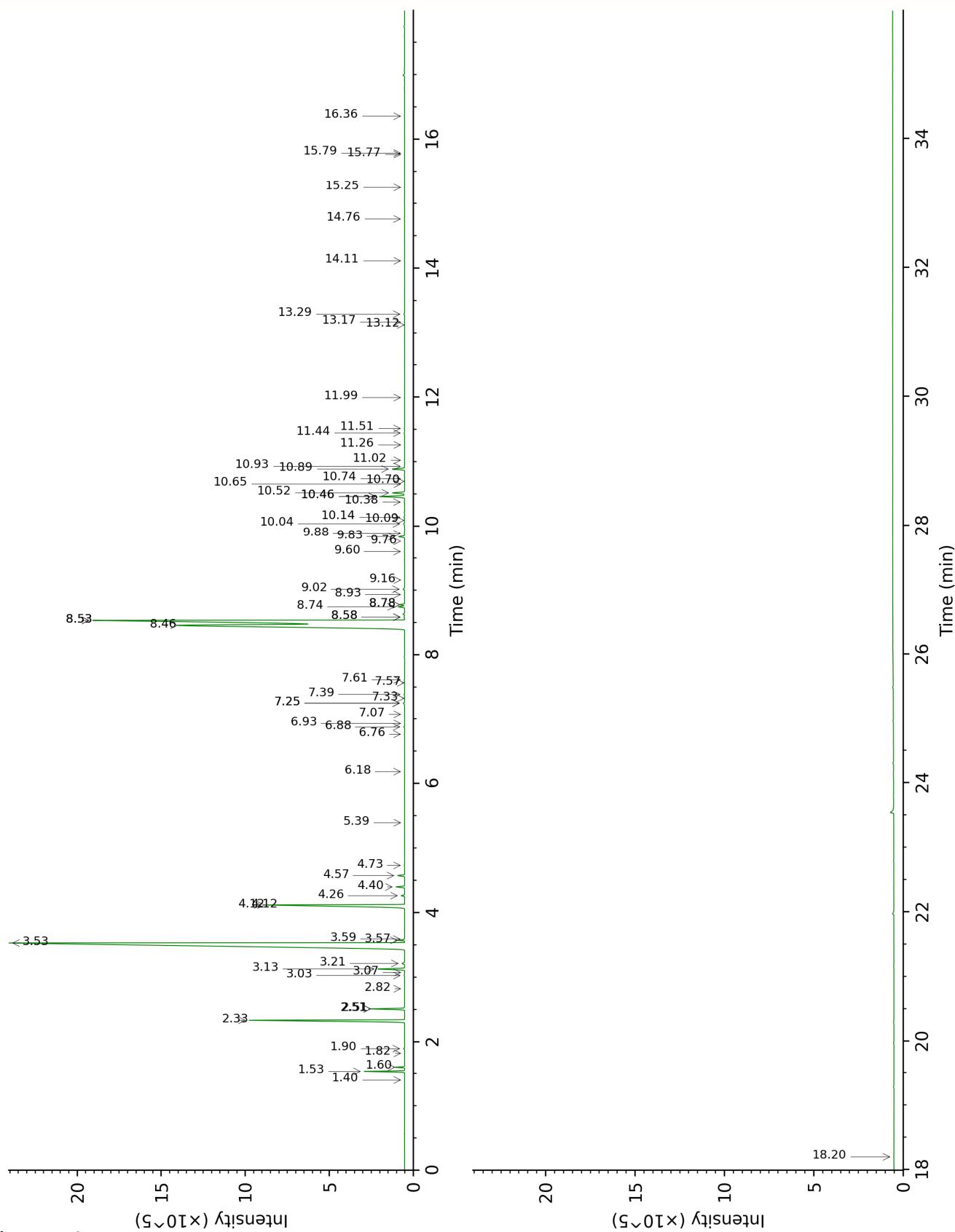
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm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

Bracketed value ([xx]): A bracketed percent value indicate that two or more compound percentage could not be solved due to coelution.

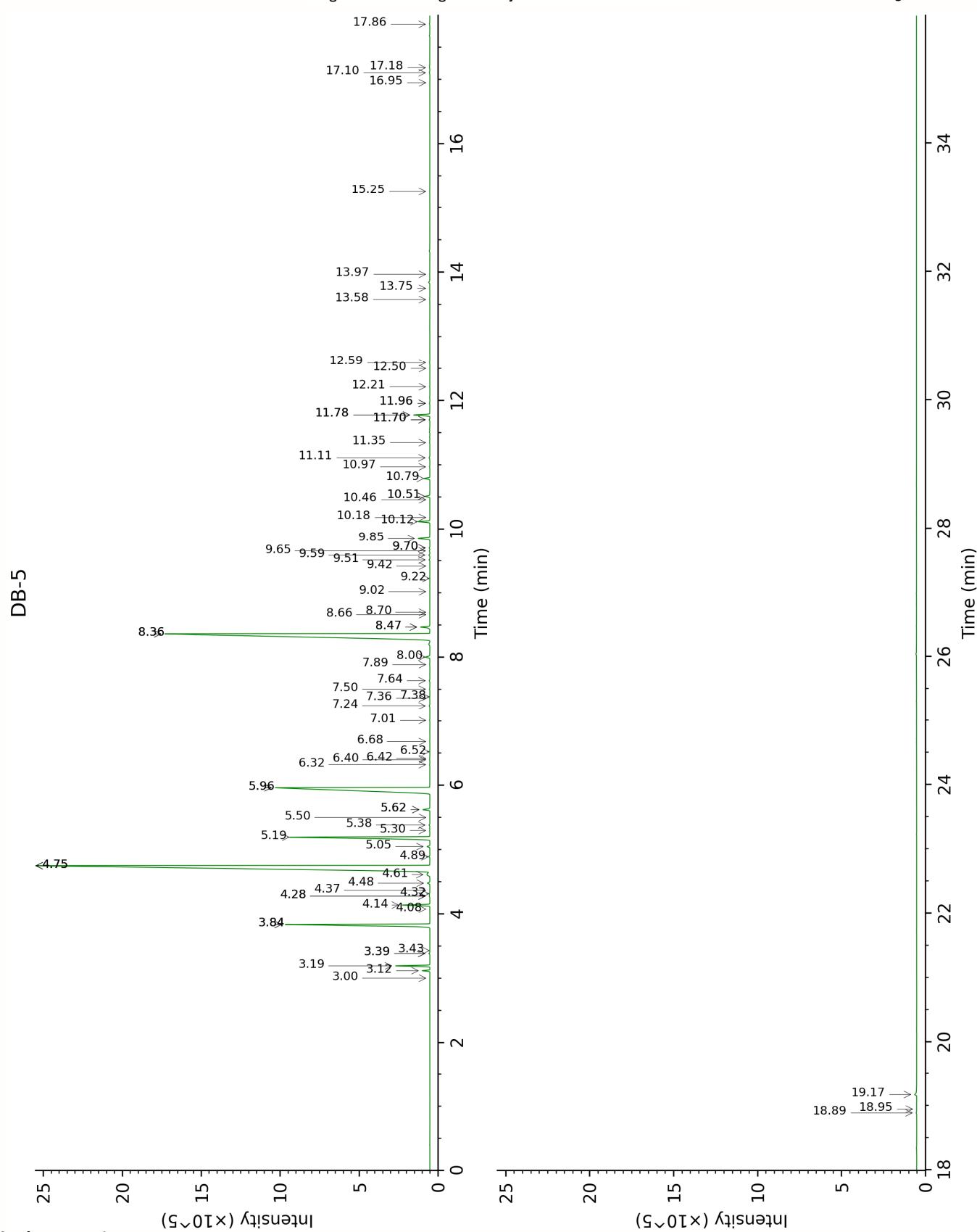
This page was intentionally left blank. The following pages present the complete data of the analysis.

DB-WAX



Laboratoire
PhytoChemia

Plus que des analyses... des conseils



FULL ANALYSIS DATA

Tricyclene	Column DB-WAX			Column DB-5		
	1.40	970.6	tr	3.00	918.7	tr
α-Thujene	1.60	996.9	0.22	3.12	926.3	0.23
α-Pinene	1.53	990.5	1.00	3.19	931.3	1.01
Camphene	1.90	1025.3	0.03	3.39*	943.9	[0.04]
α-Fenchene	1.82	1018.5	tr	3.39*	943.9	[0.04]
Thuja-2,4(10)-diene	2.51*	1084.1	[0.97]	3.43	946.8	0.01
Sabinene	2.51*	1084.1	[0.97]	3.84*	973.5	[6.84]
β-Pinene	2.34	1067.2	5.90	3.84*	973.5	[6.84]
6-Methyl-5-hepten-2-one	5.39	1296.2	0.01	4.08	989.3	0.01
Myrcene	3.13	1133.0	0.89	4.14	993.3	0.90
α-Phellandrene	3.03	1125.2	0.02	4.28*†	1002.5	[0.03]
Pseudolimonene	3.07	1128.8	tr	4.28*†	1002.5	[0.03]
Octanal	4.73	1253.4	0.01	4.32*†	1004.9	[0.02]
Δ3-Carene	2.82	1109.4	0.01	4.37	1008.2	0.01
α-Terpinene	3.21	1139.6	0.10	4.48	1015.1	0.11
para-Cymene	4.40	1229.1	0.27	4.61	1023.5	0.26
1,8-Cineole	3.59	1168.9	0.01	4.75*	1032.0	[37.87]
β-Phellandrene	3.57	1167.4	0.17	4.75*	1032.0	[37.87]
Limonene	3.53	1164.1	37.68	4.75*	1032.0	[37.87]
(Z)-β-Ocimene	4.12*	1208.7	[6.81]	4.89	1040.7	0.04
(E)-β-Ocimene	4.26	1219.2	0.11	5.05	1050.6	0.11
γ-Terpinene	4.12*	1208.7	[6.81]	5.19	1059.7	6.77
cis-Sabinene hydrate	7.25*	1431.0	[0.06]	5.30	1066.2	0.01
cis-Linalool oxide (fur.)	6.88	1403.1	0.03	5.38	1071.5	0.04
Octanol	8.53*†	1527.3	[21.91]	5.50	1078.8	0.01
trans-Linalool oxide (fur.)	7.25*	1431.0	[0.06]	5.62*	1086.5	[0.26]
Terpinolene	4.57	1241.9	0.22	5.62*	1086.5	[0.26]
Nonanal	6.18	1353.0	0.01	5.96*	1107.8	[14.90]
Linalool	8.46*†	1521.4	[19.34]	5.96*	1107.8	[14.90]
cis-Limonene oxide	6.76	1394.7	0.01	6.32	1130.6	0.01
trans-Limonene oxide	6.93	1407.0	0.01	6.40	1135.5	0.01
Camphor	7.57	1454.3	tr	6.42	1136.8	0.01
Epoxyterpinolene	7.07	1417.4	0.01	6.52	1143.4	0.01
Citronellal	7.33	1436.6	0.01	6.68	1153.5	0.01
Terpinen-4-ol	8.93	1558.0	0.01	7.01	1174.5	0.02
α-Terpineol	10.14	1653.6	0.03	7.24	1189.4	0.03
Hodiendiol (2,6-dimethylocta-3,7-	13.17	1911.9	0.01	7.36	1197.0	0.01

diene-2,6-diol)						
Unknown SASC VI [m/z 43, 71 (80), 67 (55), 59 (51), 68 (44), 41 (43)...]	11.26	1746.0	tr	7.38	1198.4	tr
Decanal	7.61	1457.8	0.02	7.50	1206.1	0.02
Octyl acetate	7.39	1441.0	0.02	7.64	1214.9	0.03
Nerol	11.44	1761.3	0.03	7.89	1231.6	0.01
Neral	9.83	1628.9	0.21	8.00	1239.5	0.20
Geraniol	11.99	1808.2	0.01	8.36*	1263.5	[26.41]
Linalyl acetate	8.53*†	1527.3	[21.91]	8.36*	1263.5	[26.41]
(<i>trans</i> ?)-Linalool oxide acetate (fur.)?	9.02	1564.4	0.07	8.47*	1270.6	[0.36]
Geranial	10.46*	1679.5	[0.95]	8.47*	1270.6	[0.36]
Bornyl acetate	8.58*	1531.2	[0.03]	8.66	1283.4	0.01
Unknown MISC VI [m/z 43, 121 (74), 93 (42), 95 (38), 107 (29), 41 (29), 136 (28)...]				8.70	1286.0	0.01
<i>cis</i> - <i>para</i> -Mentha- 2,8-diene-1- hydroperoxide				9.02	1307.5	0.01
<i>trans</i> - <i>para</i> -Mentha- 2,8-diene-1- hydroperoxide				9.22	1321.9	tr
Linalyl propionate	9.16	1575.3	0.01	9.42	1335.5	0.01
Hodiendiol derivative	13.29	1923.1	0.03	9.51	1342.3	0.03
α-Terpinyl acetate	10.04	1645.5	0.05	9.59	1347.6	0.04
Unknown MISC VII [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]				9.65	1352.1	0.02
Citronellyl acetate	9.76	1623.2	0.01	9.70*	1355.4	[0.03]
Unknown SASC III [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	11.51	1767.3	0.02	9.70*	1355.4	[0.03]
Neryl acetate	10.52	1684.0	0.44	9.85	1365.7	0.43
Geranyl acetate	10.89	1714.7	0.45	10.12	1384.9	0.44
β-Elemene	8.78*†	1546.0	[0.15]	10.18	1389.4	0.01
Dodecanal	10.38	1672.5	0.02	10.46	1409.2	0.01
<i>cis</i> -α-Bergamotene	8.58*	1531.2	[0.03]	10.51*	1413.0	[0.18]

β -Caryophyllene	8.78*†	1546.0	[0.15]	10.51*	1413.0	[0.18]
<i>trans-a-</i> Bergamotene	8.74*†	1543.5	[0.22]	10.79	1433.7	0.22
α -Humulene	9.60	1610.2	0.01	10.97	1447.0	0.01
(<i>E</i>)- β -Farnesene	9.88	1632.9	0.01	11.11	1457.5	0.03
Germacrene D	10.09	1649.8	0.02	11.35	1475.0	0.01
Hodiendiol derivative II	13.12	1907.9	0.01	11.70*	1501.4	[0.03]
(<i>Z</i>)- α -Bisabolene	10.65	1695.2	tr	11.70*	1501.4	[0.03]
β -Bisabolene	10.46*	1679.5	[0.95]	11.78*	1507.1	[0.63]
γ -Cadinene	10.70	1698.8	0.01	11.78*	1507.1	[0.63]
δ -Cadinene	10.74	1702.1	0.01	11.96*	1521.3	[0.02]
β -Sesquiphellandrene	10.93	1718.1	0.02	11.96*	1521.3	[0.02]
(<i>E</i>)- α -Bisabolene	11.02	1726.1	0.01	12.21	1541.5	0.01
(<i>E</i>)-Nerolidol	14.11	1998.2	0.01	12.50	1563.9	0.01
Spathulenol	14.76	2059.0	0.01	12.59	1571.1	0.01
Unknown CILI I [m/z 94, 43 (89), 41 (67), 122 (46), 69 (41)...222]	15.25	2106.0	0.01	13.58	1650.5	0.01
Unknown CILI II [m/z 69, 95 (100), 41 (89), 109 (68), 67 (61)...222]	16.36	2216.0	0.02	13.75	1664.8	0.01
α -Bisabolol	15.79	2158.8	0.01	13.97	1682.7	0.01
Nootkatone	18.20	2408.4	0.01	15.25	1792.6	0.01
meta-Camphorene	15.76	2156.7	0.01	16.95	1948.5	tr
Citropten				17.10	1963.2	0.03
Palmitic acid				17.18	1970.7	0.03
Bergapten				17.86	2036.1	0.02
Linoleic acid				18.89	2139.9	0.02
Oleic acid				18.95	2145.9	tr
Stearic acid				19.17	2169.4	0.14
Total reported		98.79%			99.09%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, only the first one is 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