

Date : July 29, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 21G15-PTH01

**Customer identification** : Cardamom - Guatemala - CA3108213R

**Type** : Essential oil

**Source** : *Elettaria cardamomum*

**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** : Pamela Lavoie, M.Sc., Chimiste

**Analysis date** : July 26, 2021

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow liquid

**Refractive index:**  $1.4637 \pm 0.0003$  (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
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
Hexanal	0.01	Aliphatic aldehyde
Hexanol	0.01	Aliphatic alcohol
Isoamyl acetate	0.01	Aliphatic ester
2-Methylbutyl acetate	0.01	Aliphatic ester
Heptanal	0.01	Aliphatic aldehyde
Tricyclene	tr	Monoterpene
$\alpha$ -Thujene	0.22	Monoterpene
$\alpha$ -Pinene	1.65	Monoterpene
Camphene	0.03	Monoterpene
$\alpha$ -Fenchene	0.01	Monoterpene
$\beta$ -Pinene	0.50	Monoterpene
Sabinene	4.42	Monoterpene
6-Methyl-5-hepten-2-one	0.05	Aliphatic ketone
Myrcene	1.97	Monoterpene
$\alpha$ -Phellandrene	0.02	Monoterpene
Pseudolimonene	tr	Monoterpene
Octanal	0.12	Aliphatic aldehyde
$\Delta^3$ -Carene	0.01	Monoterpene
$\alpha$ -Terpinene	0.11	Monoterpene
para-Cymene	0.18	Monoterpene
1,8-Cineole	28.15	Monoterpenic ether
Limonene	2.60	Monoterpene
(Z)- $\beta$ -Ocimene	0.04	Monoterpene
(E)- $\beta$ -Ocimene	0.10	Monoterpene
$\gamma$ -Terpinene	0.27	Monoterpene
cis-Sabinene hydrate	0.40	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.07	Aliphatic alcohol
Terpinolene	0.12	Monoterpene
para-Cymenene	0.01	Monoterpene
6,7-Epoxymyrcene	0.05	Monoterpenic ether
trans-Sabinene hydrate	0.24	Monoterpenic alcohol
Linalool	3.71	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.04	Monoterpenic alcohol
(E)-4,8-Dimethylnona-1,3,7-triene	0.07	Terpene derivative
cis-Limonene oxide	0.02	Monoterpenic ether
trans-Limonene oxide	0.01	Monoterpenic ether
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Borneol	0.01	Monoterpenic alcohol
$\delta$ -Terpineol	0.09	Monoterpenic alcohol
Terpinen-4-ol	0.95	Monoterpenic alcohol
para-Cymen-8-ol	0.02	Monoterpenic alcohol

Myrtenal	0.01	Monoterpenic aldehyde
$\alpha$ -Terpineol	1.46	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.09	Monoterpenic alcohol
<i>trans</i> -Piperitol	0.01	Monoterpenic alcohol
Decanal	0.04	Aliphatic aldehyde
Octyl acetate	0.06	Aliphatic ester
<i>cis</i> -Sabinene hydrate acetate?	0.27	Monoterpenic ester
Neral	0.30	Monoterpenic aldehyde
Geraniol	1.30	Monoterpenic alcohol
Linalyl acetate	5.63	Monoterpenic ester
(2 <i>E</i> )-Decenal	0.02	Aliphatic aldehyde
Geranial	0.42	Monoterpenic aldehyde
Bornyl acetate	0.03	Monoterpenic ester
Terpinen-4-yl acetate	0.05	Monoterpenic ester
$\delta$ -Terpinyl acetate	0.17	Monoterpenic ester
Methyl geranate	0.08	Monoterpenic ester
$\delta$ -Elemene	0.02	Sesquiterpene
$\alpha$ -Terpinyl acetate	38.36	Monoterpenic ester
Neryl acetate	0.02	Monoterpenic ester
Geranyl acetate	0.61	Monoterpenic ester
Dodecenyl acetate isomer?	0.04	Aliphatic ester
$\beta$ -Elemene	0.04	Sesquiterpene
$\beta$ -Caryophyllene	0.04	Sesquiterpene
$\alpha$ -Terpinyl propionate	0.09	Monoterpenic ester
Unknown	0.02	Sesquiterpene
8-Acetoxy- <i>trans</i> -para-Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]	0.02	Monoterpenic ester
Geranyl propionate	0.03	Monoterpenic ester
Germacrene D	0.03	Sesquiterpene
$\beta$ -Selinene	0.33	Sesquiterpene
$\alpha$ -Selinene	0.10	Sesquiterpene
$\delta$ -Amorphene	0.02	Sesquiterpene
$\gamma$ -Cadinene	0.12	Sesquiterpene
$\delta$ -Cadinene	0.02	Sesquiterpene
Germacrene B	0.07	Sesquiterpene
( <i>E</i> )-Nerolidol	1.07	Sesquiterpenic alcohol
Dendrolasin	0.01	Sesquiterpenic ether
(3 <i>E</i> ,7 <i>E</i> )-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	0.15	Terpene derivative
Unknown	0.02	Unknown
(2 <i>E</i> ,6 <i>Z</i> )-Farnesal	0.04	Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i> )-Farnesol	0.19	Sesquiterpenic alcohol
(2 <i>E</i> ,6 <i>E</i> )-Farnesal	0.07	Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i> )-Farnesyl acetate	0.05	Sesquiterpenic ester
( <i>E</i> , <i>E</i> )-Geranylinalool	0.02	Diterpenic alcohol
Coronarín <i>E</i>	0.16	Diterpene
<b>Consolidated total</b>	<b>98.04%</b>	

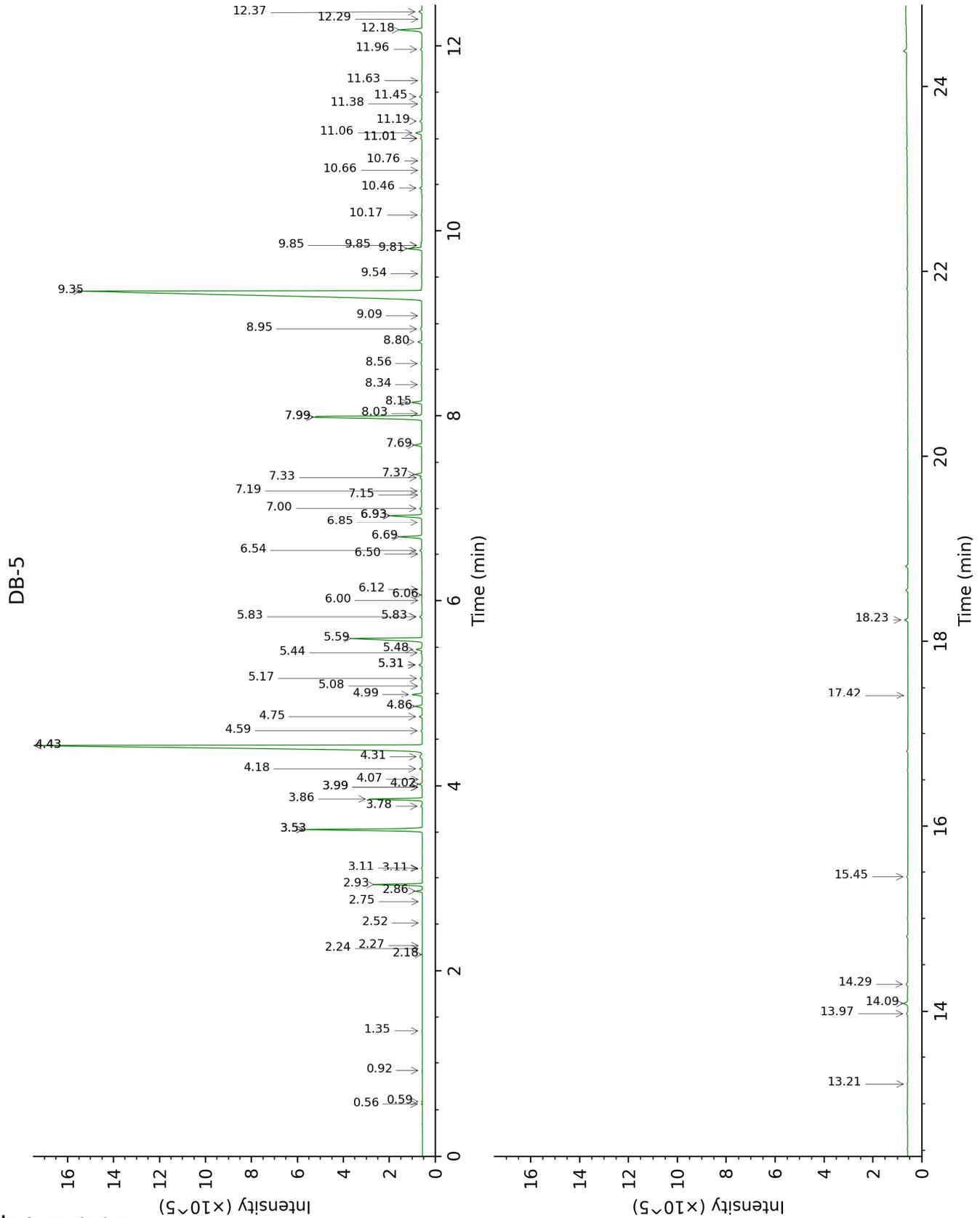
tr: The compound has been detected below 0.005% of total signal.

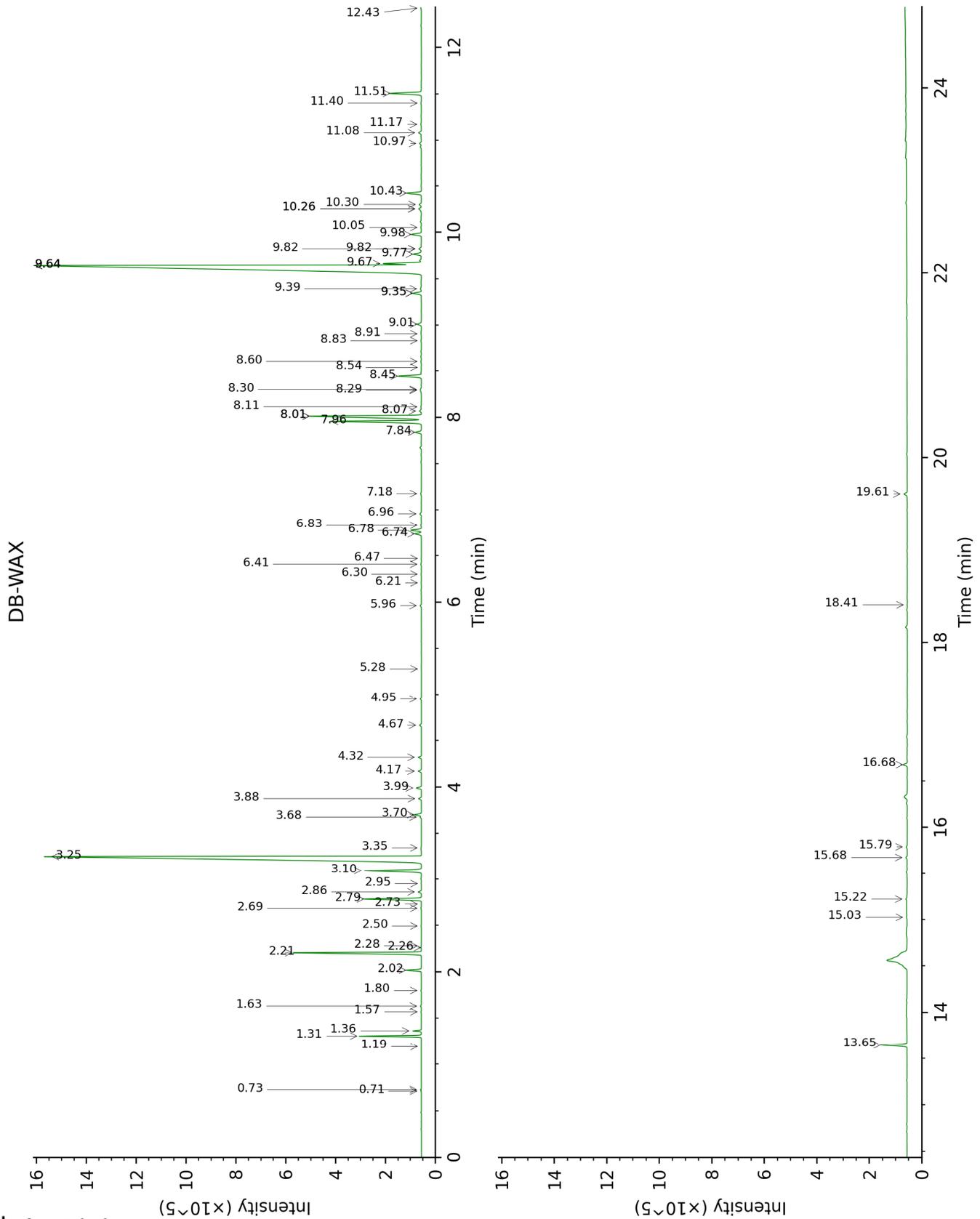
Note: no correction factor was applied

**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	0.56	642	0.02	0.73	886	0.02
2-Methylbutyral	0.59	653	0.01	0.71	880	0.01
Isoamyl alcohol	0.92	734	0.01	3.34	1179	0.01
Hexanal	1.35	800	0.01	1.80	1043	0.01
Hexanol	2.18	873	0.01	5.28	1320	tr
Isoamyl acetate	2.24	878	0.01	2.26	1091	tr
2-Methylbutyl acetate	2.27	881	0.01	2.28	1093	tr
Heptanal	2.52	902	0.01	2.95	1147	0.01
Tricyclene	2.74	918	tr	1.19	971	tr
$\alpha$ -Thujene	2.86	926	0.22	1.36	998	0.22
$\alpha$ -Pinene	2.93	930	1.65	1.31	991	1.64
Camphene	3.11†	942	0.04	1.63	1026	0.03
$\alpha$ -Fenchene	3.11†	943	[0.04]	1.57	1020	0.01
$\beta$ -Pinene	3.53*	971	4.96	2.02	1066	0.50
Sabinene	3.53*	971	[4.96]	2.21	1085	4.42
6-Methyl-5-hepten-2-one	3.78	988	0.05	4.95	1297	0.04
Myrcene	3.86	993	1.97	2.79	1134	1.95
$\alpha$ -Phellandrene	3.99*	1002	0.02	2.69	1126	0.02
Pseudolimonene	3.99*	1002	[0.02]	2.73	1130	tr
Octanal	4.02	1004	0.12	4.32	1254	0.11
$\Delta$ 3-Carene	4.07	1008	0.01	2.50	1111	0.01
$\alpha$ -Terpinene	4.18	1015	0.11	2.86	1140	0.11
para-Cymene	4.31	1023	0.18	3.99	1229	0.18
1,8-Cineole	4.44*	1031	30.76	3.25	1172	28.15
Limonene	4.44*	1031	[30.76]	3.10	1159	2.60
(Z)- $\beta$ -Ocimene	4.59	1041	0.04	3.68	1205	0.04
(E)- $\beta$ -Ocimene	4.75	1050	0.10	3.88	1220	0.10
$\gamma$ -Terpinene	4.86	1058	0.27	3.70	1207	0.26
cis-Sabinene hydrate	4.99	1066	0.40	6.78	1430	0.41
cis-Linalool oxide (fur.)	5.08	1072	0.02	6.41	1402	0.02
Octanol	5.17	1077	0.07	8.07	1527	0.08
Terpinolene	5.31*†	1086	0.14	4.17	1242	0.12
para-Cymenene	5.31*†	1086	[0.14]	6.21	1388	0.01
6,7-Epoxy-myrcene	5.44	1095	0.05	5.96	1370	0.05
trans-Sabinene hydrate	5.48	1097	0.24	7.84	1509	0.25
Linalool	5.60	1105	3.71	7.96†	1518	9.30
cis-para-Menth-2-en-1-ol	5.83*	1120	0.10	8.01*†	1523	[9.30]
(E)-4,8-Dimethylnona-1,3,7-triene	5.83*	1120	[0.10]	4.67	1280	0.07

<i>cis</i> -Limonene oxide	6.00	1131	0.02	6.30	1394	0.01
<i>trans</i> -Limonene oxide	6.06	1135	0.01	6.47	1407	tr
<i>trans</i> -para-Menth-2-en-1-ol	6.12	1139	0.02	8.83	1586	0.02
Borneol	6.50	1164	0.01	9.64*†	1651	39.61
δ-Terpineol	6.54	1166	0.09	9.35*	1627	0.36
Terpinen-4-ol	6.69	1176	0.95	8.44	1556	0.95
para-Cyemen-8-ol	6.85	1186	0.02	11.40	1798	0.02
Myrtenal	6.93*	1191	1.47	8.54	1563	0.01
α-Terpineol	6.93*	1191	[1.47]	9.67†	1653	[39.61]
<i>cis</i> -Piperitol	7.00	1196	0.09	9.39	1631	0.05
<i>trans</i> -Piperitol	7.15	1206	0.01	10.26*	1701	0.14
Decanal	7.19	1209	0.04	7.18	1459	0.03
Octyl acetate	7.33	1218	0.06	6.96	1443	0.06
<i>cis</i> -Sabinene hydrate acetate?	7.37	1221	0.27	6.74	1427	0.27
Neral	7.69	1242	0.30	9.35*	1627	[0.36]
Geraniol	7.99*†	1263	6.92	11.51	1808	1.30
Linalyl acetate	7.99*†	1263	[6.92]	8.01*†	1523	[9.30]
(2 <i>E</i> )-Decenal	8.03	1266	0.02	8.91	1592	0.02
Geranial	8.15	1274	0.42	9.98	1678	0.41
Bornyl acetate	8.34	1287	0.03	8.11	1530	0.03
Terpinen-4-yl acetate	8.56	1302	0.05	8.60	1568	0.03
δ-Terpinyl acetate	8.80	1316	0.17	9.01	1600	0.17
Methyl geranate	8.94	1326	0.08	9.64*†	1651	[39.61]
δ-Elemene	9.09	1336	0.02	6.83	1434	0.02
α-Terpinyl acetate	9.35	1355	38.36	9.64*†	1651	[39.61]
Neryl acetate	9.54	1368	0.02	10.05	1684	0.02
Geranyl acetate	9.81	1387	0.61	10.42	1716	0.60
Dodecenyl acetate isomer?	9.84*	1390	0.08			
β-Elemene	9.84*	1390	[0.08]	8.30†	1545	[0.08]
β-Caryophyllene	10.17	1413	0.04	8.29†	1544	0.08
α-Terpinyl propionate	10.46	1435	0.09			
Unknown [m/z 43, 109 (35), 96 (23), 93 (22), 137 (21), 81 (20)...204 (5)]	10.66	1450	0.02			
8-Acetoxy- <i>trans</i> -para-Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]	10.76	1458	0.02	15.03	2135	0.02

Geranyl propionate	11.01*	1476	0.06	11.17	1779	0.03
Germacrene D	11.01*	1476	[0.06]	9.64*†	1651	[39.61]
β-Selinene	11.06	1480	0.33	9.77	1661	0.35
α-Selinene	11.19	1490	0.10	9.82*	1666	0.11
δ-Amorphene	11.38	1503	0.02	9.82*	1666	[0.11]
γ-Cadinene	11.45	1510	0.12	10.26*	1701	[0.14]
δ-Cadinene	11.63	1523	0.02	10.30	1705	0.09
Germacrene B	11.96	1550	0.07	10.97	1761	0.08
(E)-Nerolidol	12.18	1567	1.07	13.65	2001	1.04
Dendrolasin	12.29	1576	0.01	12.43	1889	0.03
(3E,7E)-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	12.37	1582	0.15	11.08	1771	0.12
Unknown [m/z 43, 135 (59), 94 (33), 59 (25), 137 (25), 93 (19)...]	13.21	1651	0.02			
(2E,6Z)-Farnesal	13.98	1714	0.04	15.22	2155	0.04
(2E,6E)-Farnesol	14.09	1724	0.19	16.68	2304	0.19
(2E,6E)-Farnesal	14.29	1742	0.07	15.68	2200	0.07
(2E,6E)-Farnesyl acetate	15.45	1845	0.05	15.79	2212	0.05
(E,E)-Geranyllinalool	17.42	2031	0.02	18.41	2494	0.01
Coronarín E	18.23	2112	0.16	19.61	2633	0.16
<b>Total identified</b>		<b>98.06%</b>			<b>97.35%</b>	
<b>Total reported</b>		<b>98.10%</b>			<b>97.35%</b>	

\*: 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