

Date : 2024-11-26

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 24K12-PTH02

**Customer Identification :** Cardamom - Guatemala - CA3111R

**Type :** Essential Oil

**Source :** *Elettaria cardamomum*

**Customer :** Plant Therapy

Checked and approved by:

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

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## GAS CHROMATOGRAPHIC ANALYSIS

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

**\*ISO**

**Results :** See analysis summary (next page)

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

**Date :** 2024-11-19

## PHYSICOCHEMICAL DATA

**Refractive index :**  $1.4629 \pm 0.0003$  (20 °C)

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

**Analyst :** Cindy Caron B. Sc.

**Date :** 2024-11-14

## 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
Ethanol	tr	Aliphatic alcohol
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Hexanal	0.01	Aliphatic aldehyde
Isoamyl acetate	tr	Aliphatic ester
2-Methylbutyl acetate	tr	Aliphatic ester
$\alpha$ -Thujene	0.23	Monoterpene
$\alpha$ -Pinene	1.63	Monoterpene
$\alpha$ -Fenchene	0.01	Monoterpene
Camphene	0.03	Monoterpene
$\beta$ -Pinene	0.41	Monoterpene
Sabinene	4.30	Monoterpene
6-Methyl-5-hepten-2-one	0.07	Aliphatic ketone
Myrcene	2.17	Monoterpene
$\alpha$ -Phellandrene	0.02	Monoterpene
Octanal	0.12	Aliphatic aldehyde
$\Delta^3$ -Carene	0.01	Monoterpene
$\alpha$ -Terpinene	0.19	Monoterpene
<i>para</i> -Cymene	0.12	Monoterpene
Limonene	2.66	Monoterpene
1,8-Cineole	33.57	Monoterpenic ether
( <i>Z</i> )- $\beta$ -Ocimene	0.03	Monoterpene
( <i>E</i> )- $\beta$ -Ocimene	0.07	Monoterpene
$\gamma$ -Terpinene	0.39	Monoterpene
<i>cis</i> -Sabinene hydrate	0.40	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.04	Aliphatic alcohol
Terpinolene	0.15	Monoterpene
6,7-Epoxyterpinene	0.04	Monoterpenic ether
<i>trans</i> -Sabinene hydrate	0.24	Monoterpenic alcohol
Linalool	2.55	Monoterpenic alcohol
( <i>E</i> )-4,8-Dimethyl-1,3,7-nonatriene	0.08	Monoterpene
<i>cis-para</i> -Menth-2-en-1-ol	0.04	Monoterpenic alcohol
<i>cis</i> -Limonene oxide	0.01	Monoterpenic ether
<i>trans-para</i> -Menth-2-en-1-ol	0.03	Monoterpenic alcohol
Borneol	0.02	Monoterpenic alcohol
$\delta$ -Terpineol	0.10	Monoterpenic alcohol
Terpinen-4-ol	0.94	Monoterpenic alcohol

<i>para</i> -Cymen-8-ol	0.02	Monoterpenic alcohol
$\alpha$ -Terpineol	1.38	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.01	Monoterpenic alcohol
(4 <i>Z</i> )-Decenal	0.04	Aliphatic aldehyde
Decanal	0.04	Aliphatic aldehyde
Octyl acetate	0.05	Aliphatic ester
<i>cis</i> -Sabinene hydrate acetate?	0.34	Monoterpenic ester
<i>exo</i> -2-Hydroxycineole	0.01	Monoterpenic alcohol
<i>cis</i> -Carveol	0.02	Monoterpenic alcohol
Neral	0.27	Monoterpenic aldehyde
(2 <i>E</i> )-Decenal	0.01	Aliphatic aldehyde
Geraniol	0.97	Monoterpenic alcohol
Linalyl acetate	4.69	Monoterpenic ester
Geranial	0.36	Monoterpenic aldehyde
Bornyl acetate	0.03	Monoterpenic ester
2-Undecanone	0.01	Aliphatic ketone
(4 <i>E</i> )-Undecenal	0.03	Aliphatic aldehyde
Terpinen-4-yl acetate	0.03	Monoterpenic ester
Geranyl formate	0.02	Monoterpenic ester
$\delta$ -Terpinyl acetate	0.17	Monoterpenic ester
Methyl geranate	0.06	Monoterpenic ester
$\delta$ -Elemene	0.02	Sesquiterpene
$\alpha$ -Terpinyl acetate	37.83	Monoterpenic ester
Neryl acetate	0.02	Monoterpenic ester
Geranyl acetate	0.48	Monoterpenic ester
Dodecenylyl acetate isomer?	0.04	Aliphatic ester
Dodecenal isomer	0.05	Aliphatic aldehyde
$\beta$ -Elemene	0.04	Sesquiterpene
$\beta$ -Caryophyllene	0.05	Sesquiterpene
$\alpha$ -Terpinyl propionate	0.07	Monoterpenic ester
Unknown	0.03	Sesquiterpene
Geranylacetone	0.02	Monoterpenic ketone
8-Acetoxy- <i>trans-para</i> -Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]	0.02	Monoterpenic ester
Unknown ELCA XVII [m/z 43, 109 (32), 41 (22), 69 (21)...]	0.01	Unknown
Geranyl propionate	0.01	Monoterpenic ester
Germacrene D	0.08	Sesquiterpene
$\beta$ -Selinene	0.29	Sesquiterpene
$\alpha$ -Selinene	0.11	Sesquiterpene
Unknown	0.04	Unknown
$\delta$ -Amorphene	0.03	Sesquiterpene
$\gamma$ -Cadinene	0.13	Sesquiterpene
$\delta$ -Cadinene	0.02	Sesquiterpene

Germacrene B	0.08	Sesquiterpene
(E)-Nerolidol	0.67	Sesquiterpenic alcohol
Dendrolasin	0.01	Sesquiterpenic ether
(3E,7E)-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	0.12	Terpene derivative
Unknown	0.01	Oxygenated sesquiterpene
(2E,6Z)-Farnesal	0.02	Sesquiterpenic aldehyde
(2E,6E)-Farnesol	0.04	Sesquiterpenic alcohol
(2E,6E)-Farnesal	0.04	Sesquiterpenic aldehyde
$\gamma$ -Bicyclohomofarnesal	0.02	Terpenic aldehyde
(2E,6E)-Farnesyl acetate	0.02	Sesquiterpenic ester
Coronarín E	0.03	Diterpene
<b>Consolidated total</b>	<b>99.78</b>	

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

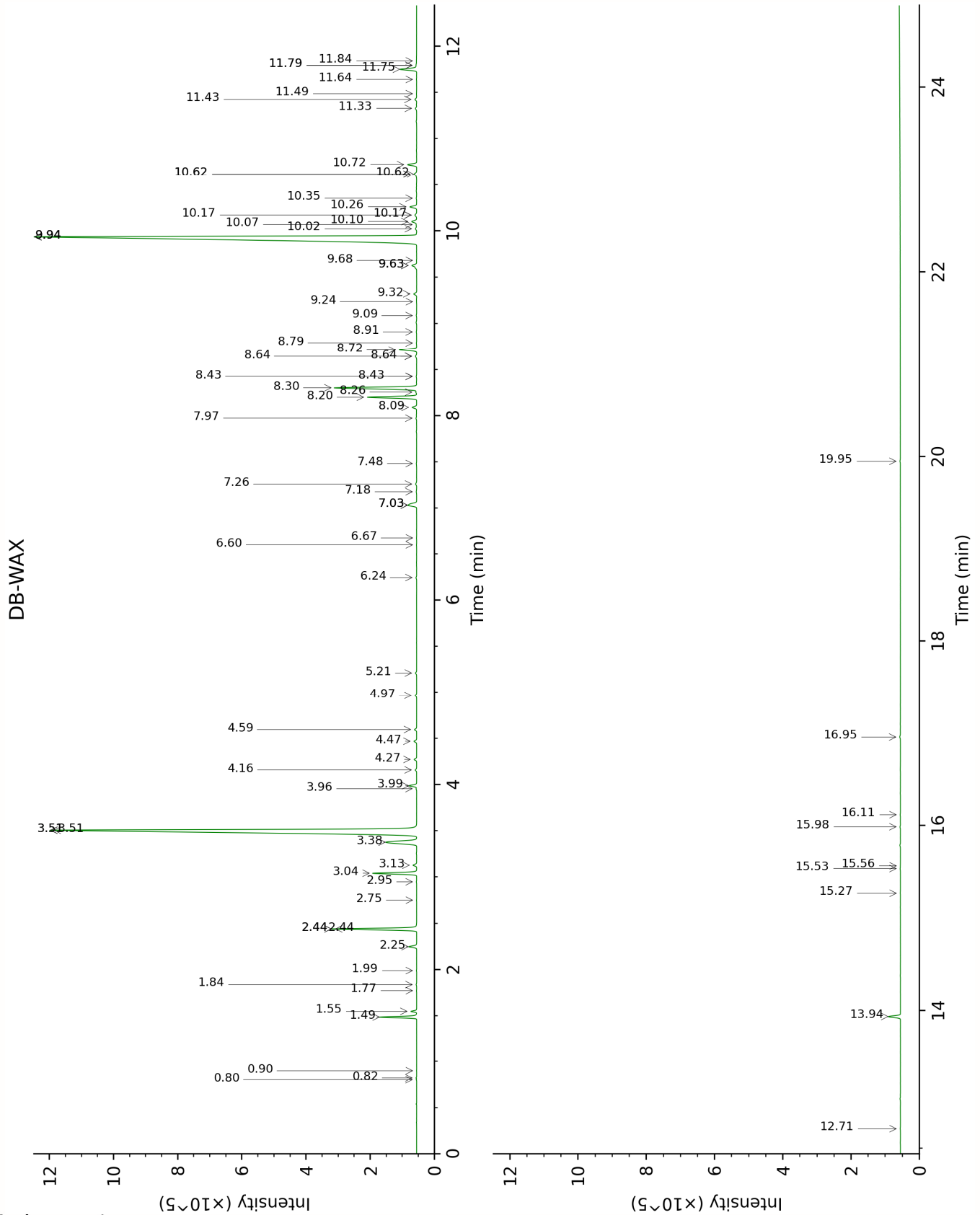
Note: no correction factor was applied

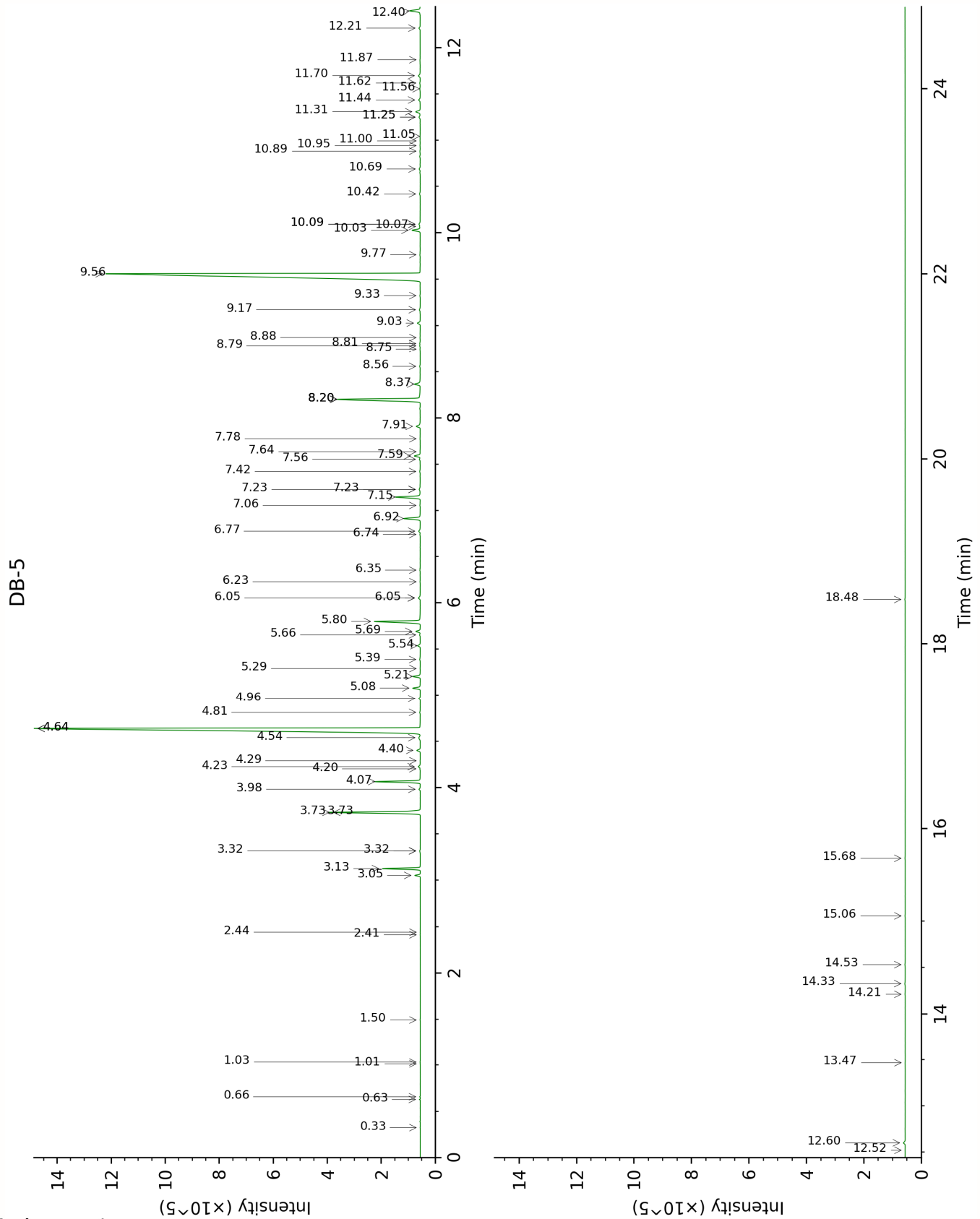
**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm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







FULL ANALYSIS DATA

Ethanol	Column DB-WAX			Column DB-5		
	0.90	907.1	tr	0.33	499.8	tr
Isovaleral	0.82	887.7	0.02	0.63	641.5	0.02
2-Methylbutyral	0.80	881.5	0.01	0.66	651.7	0.01
Isoamyl alcohol	3.51*	1172.5	[33.54]	1.01	733.2	0.01
2-Methylbutanol	3.51*	1172.5	[33.54]	1.03	735.9	0.01
Hexanal	1.99	1043.9	0.01	1.50	800.7	0.01
Isoamyl acetate	2.44*	1087.0	[4.32]	2.41	878.7	tr
2-Methylbutyl acetate	2.44*	1087.0	[4.32]	2.44	881.0	tr
$\alpha$ -Thujene	1.55	1002.3	0.24	3.05	926.4	0.23
$\alpha$ -Pinene	1.49	994.6	1.63	3.13	931.3	1.63
$\alpha$ -Fenchene	1.77	1023.3	0.01	3.32*	943.9	[0.04]
Camphene	1.84	1029.6	0.03	3.32*	943.9	[0.04]
$\beta$ -Pinene	2.25	1068.5	0.41	3.73*	971.5	[4.71]
Sabinene	2.44*	1087.0	[4.32]	3.73*	971.5	[4.71]
6-Methyl-5-hepten-2-one	5.21	1302.2	0.07	3.98	987.9	0.07
Myrcene	3.04	1136.1	2.19	4.07	993.4	2.17
$\alpha$ -Phellandrene	2.95	1128.8	0.02	4.20	1002.5	0.02
Octanal	4.60	1255.5	0.12	4.23	1004.1	0.12
$\Delta^3$ -Carene	2.75	1113.4	0.01	4.29	1008.1	0.01
$\alpha$ -Terpinene	3.13	1142.9	0.19	4.40	1015.2	0.19
<i>para</i> -Cymene	4.27	1231.2	0.14	4.54	1023.7	0.12
Limonene	3.38	1162.4	2.66	4.64*	1030.0	[36.23]
1,8-Cineole	3.51*	1172.5	[33.54]	4.64*	1030.0	[36.23]
(Z)- $\beta$ -Ocimene	3.96	1207.7	0.03	4.81	1040.9	0.03
(E)- $\beta$ -Ocimene	4.16	1222.8	0.08	4.96	1050.5	0.07
$\gamma$ -Terpinene	3.99	1210.0	0.40	5.08	1057.7	0.39
<i>cis</i> -Sabinene hydrate	7.03*	1426.4	[0.73]	5.21	1065.7	0.40
<i>cis</i> -Linalool oxide (fur.)	6.67	1399.4	0.01	5.29	1071.0	0.01
Octanol	8.43*	1531.6	[0.03]	5.39	1077.1	0.04
Terpinolene	4.47	1246.0	0.15	5.54	1086.4	0.15
6,7-Epoxyterpinene	6.24	1368.4	0.04	5.66	1093.8	0.04
<i>trans</i> -Sabinene hydrate	8.09	1505.5	0.25	5.69	1096.1	0.24
Linalool	8.20	1514.1	2.58	5.80	1102.9	2.55
(E)-4,8-Dimethyl-1,3,7-nonatriene	4.97	1283.6	0.08	6.05*	1119.0	[0.13]
<i>cis-para</i> -Menth-2-en-1-ol	8.26	1518.4	0.04	6.05*	1119.0	[0.13]
<i>cis</i> -Limonene oxide	6.60	1394.0	0.01	6.23	1130.2	0.01
<i>trans-para</i> -Menth-2-	9.09	1583.3	0.03	6.35	1138.2	0.03

en-1-ol						
Borneol	9.94*	1651.5	[39.09]	6.74	1162.8	0.02
$\delta$ -Terpineol	9.63*†	1626.4	[0.30]	6.77	1165.1	0.10
Terpinen-4-ol	8.72	1554.3	0.93	6.92	1174.3	0.94
<i>para</i> -Cymen-8-ol	11.64	1794.3	0.01	7.06	1183.3	0.02
$\alpha$ -Terpineol	9.94*	1651.5	[39.09]	7.15	1189.1	1.38
<i>cis</i> -Piperitol	9.68	1630.8	0.01	7.23*	1194.4	[0.09]
(4Z)-Decenal	7.97	1496.5	0.04	7.23*	1194.4	[0.09]
Decanal	7.48	1460.0	0.03	7.42	1206.8	0.04
Octyl acetate	7.26	1443.4	0.07	7.56	1215.6	0.05
<i>cis</i> -Sabinene hydrate acetate?	7.03*	1426.4	[0.73]	7.59	1218.1	0.34
exo-2-Hydroxycineole	11.79*	1807.6	[0.04]	7.64	1221.1	0.01
<i>cis</i> -Carveol	11.84	1811.8	0.02	7.78	1230.5	0.02
Neral	9.63*†	1626.4	[0.30]	7.91	1239.4	0.27
(2E)-Decenal	9.24	1594.9	0.01	8.20*	1259.0	[5.63]
Geraniol	11.75	1803.8	0.97	8.20*	1259.0	[5.63]
Linalyl acetate	8.30	1522.0	4.69	8.20*	1259.0	[5.63]
Geranial	10.26	1677.7	0.39	8.37	1270.0	0.36
Bornyl acetate	8.43*	1531.6	[0.03]	8.56	1282.8	0.03
2-Undecanone	8.79	1560.2	0.03	8.75	1295.7	0.01
(4E)-Undecenal				8.79	1298.1	0.03
Terpinen-4-yl acetate	8.91	1569.5	0.03	8.81	1299.7	0.03
Geranyl formate	10.07	1662.1	0.03	8.88	1304.0	0.02
$\delta$ -Terpinyl acetate	9.32	1601.5	0.17	9.03	1315.0	0.17
Methyl geranate	9.94*	1651.5	[39.09]	9.17	1325.1	0.06
$\delta$ -Elemene	7.18	1437.2	0.04	9.33	1335.8	0.02
$\alpha$ -Terpinyl acetate	9.94*	1651.5	[39.09]	9.56	1352.4	37.83
Neryl acetate	10.35	1685.2	0.04	9.76	1366.8	0.02
Geranyl acetate	10.72	1716.0	0.50	10.03	1385.4	0.48
Dodecenyl acetate isomer?				10.07	1388.3	0.04
Dodecenal isomer				10.09*	1390.0	[0.09]
$\beta$ -Elemene	8.64*	1548.6	[0.09]	10.09*	1390.0	[0.09]
$\beta$ -Caryophyllene	8.64*	1548.6	[0.09]	10.42	1413.4	0.05
$\alpha$ -Terpinyl propionate	10.62*	1707.0	[0.21]	10.69	1433.9	0.07
Unknown ELCA I [m/z 43, 109 (35), 96 (23), 93 (22), 137 (21), 81 (20)...204 (5)]				10.89	1448.3	0.03
Geranylacetone	11.79*	1807.6	[0.04]	10.95	1452.8	0.02
8-Acetoxy- <i>trans</i> -	15.27	2131.5	0.01	11.00	1456.6	0.02

<i>para</i> -Menth-2-en-1-ol [2-(4-Hydroxy-4-methylcyclohex-2-enyl)propan-2-yl acetate]						
Unknown ELCA XVII [m/z 43, 109 (32), 41 (22), 69 (21)...]				11.05	1460.2	0.01
Geranyl propionate	11.49	1781.2	0.01	11.25*	1475.6	[0.09]
Germacrene D	10.02	1658.5	0.08	11.25*	1475.6	[0.09]
$\beta$ -Selinene	10.10	1664.8	0.31	11.31	1480.0	0.29
$\alpha$ -Selinene	10.17*	1670.5	[0.12]	11.44	1489.4	0.11
Unknown ELCA VIII [m/z 150, 82 (86), 43 (59), 135 (58), 110 (53), 95 (45), 69 (29)...]				11.56	1498.4	0.04
$\delta$ -Amorphene	10.17*	1670.5	[0.12]	11.62	1503.0	0.03
$\gamma$ -Cadinene	10.62*	1707.0	[0.21]	11.70	1509.1	0.13
$\delta$ -Cadinene	10.62*	1707.0	[0.21]	11.87	1522.6	0.02
Germacrene B	11.33	1767.7	0.08	12.21	1549.5	0.08
( <i>E</i> )-Nerolidol	13.94	2001.9	0.64	12.40	1564.1	0.67
Dendrolasin	12.71	1889.2	0.02	12.52	1573.8	0.01
(3 <i>E</i> ,7 <i>E</i> )-4,8,12-Trimethyl-1,3,7,11-tridecatetraene	11.43	1775.9	0.10	12.60	1580.1	0.12
Unknown JUVI XVI [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	15.56	2161.1	0.01	13.47	1650.4	0.01
(2 <i>E</i> ,6 <i>Z</i> )-Farnesal	15.53	2158.1	0.02	14.21	1712.4	0.02
(2 <i>E</i> ,6 <i>E</i> )-Farnesol	16.95	2304.5	0.06	14.33	1722.4	0.04
(2 <i>E</i> ,6 <i>E</i> )-Farnesal	15.98	2203.5	0.03	14.53	1740.1	0.04
$\gamma$ -Bicyclohomofarnesal				15.06	1785.8	0.02
(2 <i>E</i> ,6 <i>E</i> )-Farnesyl acetate	16.12	2217.0	0.02	15.68	1841.4	0.02
Coronarín E	19.95	2641.7	0.03	18.48	2109.4	0.03
Total reported		99.45%			99.76%	

\*: 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.

Essential Oil, *Elettaria cardamomum*  
Internal code: 24K12-PTH02

Cardamom - Guatemala - CA3111R

Report prepared for:  
Plant Therapy

Note: no correction factor was applied  
R.T.: Retention time (minutes)  
R.I.: Retention index