

Date : August 25, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 20H18-PTH07


**Customer identification** : Clary Sage - Russia - CF0110205R

**Type** : Essential oil

**Source** : *Salvia sclarea*

**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** : Fanny Charlier, B. Sc., chimiste à l'entraînement

**Analysis date** : August 19, 2020

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:** 1.4597 ± 0.0003 (20 °C; method PC-MAT-016)

*NFT 75-255:1992 - CLARY SAGE OIL - FRESHLY CRUSHED*

<b>Compound</b>	<b>Min. %</b>	<b>Max. %</b>	<b>Observed %</b>	<b>Complies?</b>
Sclareol	0.4	2.6	0.5	Yes
Germacrene D	1.2	7.5	3.5	Yes
α-Terpineol	1	5	3	Yes
Linalyl acetate	56.0	70.5	56.7	Yes
Linalool	13	24	22	Yes
<b>Refractive index</b>	1.456	1.466	1.460	Yes

*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	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Hexanal	0.01	Aliphatic aldehyde
(2E)-Hexenal	0.03	Aliphatic aldehyde
(3Z)-Hexenol	0.11	Aliphatic alcohol
(2E)-Hexenol	0.11	Aliphatic alcohol
Hexanol	0.09	Aliphatic alcohol
$\alpha$ -Pinene	0.05	Monoterpene
$\alpha$ -Fenchene	tr	Monoterpene
Camphene	0.01	Monoterpene
$\beta$ -Pinene	0.06	Monoterpene
Sabinene	0.02	Monoterpene
Octen-3-ol	0.05	Aliphatic alcohol
Octan-3-one	0.01	Aliphatic ketone
Myrcene	0.83	Monoterpene
<i>trans</i> -Dehydroxylinalool oxide	0.06	Monoterpenic ether
Octan-3-ol	0.01	Aliphatic alcohol
<i>cis</i> -Dehydroxylinalool oxide	0.02	Monoterpenic ether
$\Delta^3$ -Carene	0.06	Monoterpene
$\alpha$ -Terpinene	0.02	Monoterpene
para-Cymene	0.03	Monoterpene
Limonene	0.25	Monoterpene
$\beta$ -Phellandrene	0.01	Monoterpene
1,8-Cineole	tr	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.34	Monoterpene
(E)- $\beta$ -Ocimene	0.66	Monoterpene
$\gamma$ -Terpinene	0.03	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Terpinolene	0.19	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Linalool	21.67	Monoterpenic alcohol
Hotrienol	0.04	Monoterpenic alcohol
Dehydrosabinaketone	0.01	Normoterpenic ketone
Unknown	0.01	Unknown
allo-Ocimene	0.01	Monoterpene
Camphor	0.06	Monoterpenic ketone
Nerol oxide	0.04	Aliphatic ether
Borneol	0.05	Monoterpenic alcohol
$\delta$ -Terpineol	0.01	Monoterpenic alcohol
Terpinen-4-ol	0.05	Monoterpenic alcohol
$\alpha$ -Terpineol	2.74	Monoterpenic alcohol
Hodiendiol	0.01	Monoterpenic alcohol
Unknown	0.04	Unknown

Unknown	0.01	Unknown
Linalyl formate	0.29	Monoterpenic ester
Nerol	0.53	Monoterpenic alcohol
Neral	0.01	Monoterpenic aldehyde
Geraniol	1.38	Monoterpenic alcohol
Linalyl acetate	56.66	Monoterpenic ester
Geranial	0.05	Monoterpenic aldehyde
Unknown	0.04	Unknown
Neryl formate	0.06	Monoterpenic ester
Bornyl acetate	0.03	Monoterpenic ester
Thymol	0.01	Monoterpenic alcohol
Geranyl formate	0.13	Monoterpenic ester
Hodiendiol derivative	0.05	Oxygenated monoterpene
$\alpha$ -Cubebene	0.03	Sesquiterpene
$\alpha$ -Terpinyl acetate	0.05	Monoterpenic ester
Unknown	0.02	Monoterpenic ester
Unknown	0.03	Oxygenated monoterpene
Neryl acetate	0.83	Monoterpenic ester
$\alpha$ -Copaene	0.57	Sesquiterpene
$\beta$ -Bourbonene	0.15	Sesquiterpene
1,5-diepi- $\beta$ -Bourbonene	0.01	Sesquiterpene
Geranyl acetate	1.52	Monoterpenic ester
$\beta$ -Cubebene	0.15	Sesquiterpene
$\beta$ -Elemene	0.14	Sesquiterpene
$\alpha$ -Gurjunene	0.01	Sesquiterpene
$\beta$ -Caryophyllene	2.14	Sesquiterpene
Coumarin	0.04	Coumarin
<i>trans</i> - $\alpha$ -Bergamotene	0.02	Sesquiterpene
$\alpha$ -Humulene	0.10	Sesquiterpene
9-epi- $\beta$ -Caryophyllene	0.01	Sesquiterpene
$\alpha$ -Amorphene	0.03	Sesquiterpene
Germacrene D	3.46	Sesquiterpene
$\beta$ -Selinene	0.03	Sesquiterpene
Hodiendiol derivative IV	0.08	Oxygenated monoterpene
Bicyclogermacrene	0.66	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.09	Sesquiterpene
$\alpha$ -Muurolene	tr	Sesquiterpene
$\gamma$ -Cadinene	0.11	Sesquiterpene
$\delta$ -Cadinene	0.15	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.03	Sesquiterpene
$\alpha$ -Calacorene	0.01	Sesquiterpene
Isocaryophyllene epoxide B	0.02	Sesquiterpenic ether
Spathulenol	0.08	Sesquiterpenic alcohol
Caryophyllene oxide	0.19	Sesquiterpenic ether
Salvial-4(14)-en-1-one	0.02	Aliphatic alcohol
Guaiol	0.04	Sesquiterpenic alcohol
Unknown	0.07	Oxygenated sesquiterpene
Unknown	0.07	Unknown
$\tau$ -Cadinol	0.01	Sesquiterpenic alcohol
$\beta$ -Eudesmol	0.06	Sesquiterpenic alcohol
$\alpha$ -Eudesmol	0.06	Sesquiterpenic alcohol
$\alpha$ -Cadinol	0.01	Sesquiterpenic alcohol

Bulnesol	0.02	Sesquiterpenic alcohol
Unknown	0.01	Unknown
Phytone	0.01	Terpenic ketone
Unknown	0.03	Unknown
Geranyl-para-cymene	0.04	Diterpene
Manoyl oxide	0.01	Diterpenic ether
Manool	0.02	Diterpenic alcohol
Sclareol	0.48	Diterpenic alcohol
<b>Consolidated total</b>	<b>98.87%</b>	

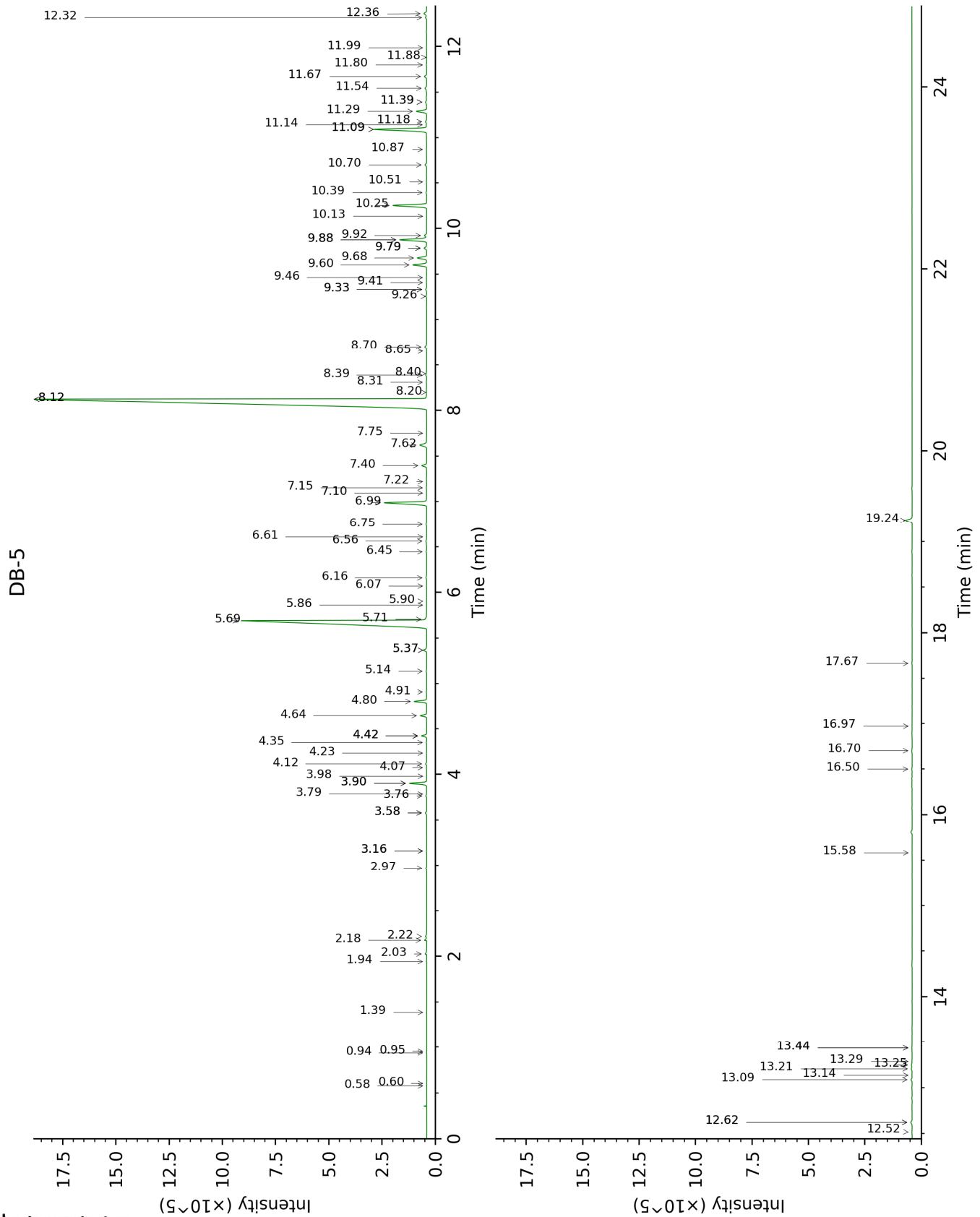
tr: The compound has been detected below 0.005% of total signal.

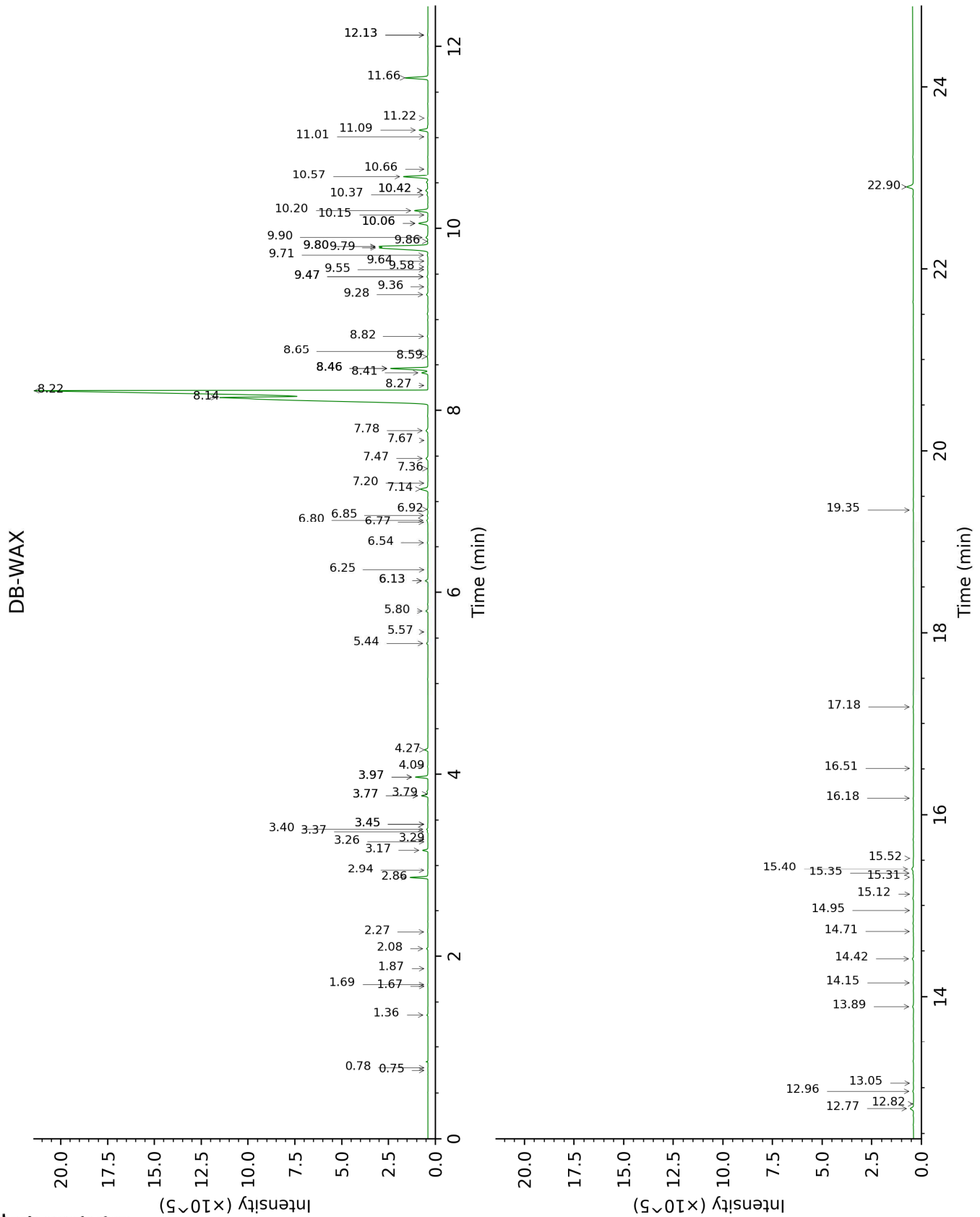
Note: no correction factor was applied

**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	0.58	642	tr	0.78	891	tr
2-Methylbutyral	0.60	652	tr	0.75	880	tr
Isoamyl alcohol	0.94	734	0.01	3.45*	1181	0.02
2-Methylbutanol	0.95	737	0.01	3.45*	1181	[0.02]
Hexanal	1.39	801	0.01	1.87	1045	0.01
(2E)-Hexenal	1.94	850	0.03	3.37	1174	0.03
(3Z)-Hexenol	2.03	857	0.11	5.80	1349	0.12
(2E)-Hexenol	2.18	870	0.11	6.13*	1372	0.15
Hexanol	2.22	873	0.09	5.44	1323	0.08
α-Pinene	2.97	930	0.05	1.36	992	0.04
α-Fenchene	3.16*	943	0.01	1.67	1025	tr
Camphene	3.16*	943	[0.01]	1.69	1027	0.01
β-Pinene	3.58*	971	0.08	2.08	1067	0.06
Sabinene	3.58*	971	[0.08]	2.27	1085	0.02
Octen-3-ol	3.76	983	0.05	6.80	1421	0.07
Octan-3-one	3.78	984	0.01	3.97*	1220	0.66
Myrcene	3.90*	992	0.92	2.86	1135	0.83
<i>trans</i> -Dehydroxylinalool oxide	3.90*	992	[0.92]	3.40	1176	0.06
Octan-3-ol	3.98	998	0.01	6.13*	1372	[0.15]
<i>cis</i> -Dehydroxylinalool oxide	4.07	1004	0.02	3.77*†	1205	0.41
Δ <sup>3</sup> -Carene	4.12	1006	0.06			
α-Terpinene	4.23	1014	0.02	2.94	1141	0.02
para-Cymene	4.35	1021	0.03	4.09	1228	0.03
Limonene	4.42*	1026	0.28	3.17	1158	0.25
β-Phellandrene	4.42*	1026	[0.28]	3.26	1166	0.01
1,8-Cineole	4.42*	1026	[0.28]	3.29	1168	tr
(Z)-β-Ocimene	4.64	1040	0.34	3.77*†	1205	[0.41]
(E)-β-Ocimene	4.80	1050	0.66	3.97*	1220	[0.66]
γ-Terpinene	4.91	1057	0.03	3.79†	1206	[0.41]
<i>cis</i> -Linalool oxide (fur.)	5.14	1071	0.03	6.54	1402	0.04
Terpinolene	5.37*	1086	0.21	4.27	1241	0.19
<i>trans</i> -Linalool oxide (fur.)	5.37*	1086	[0.21]	6.92	1430	0.03
Linalool	5.69†	1106	21.71	8.14†	1522	77.78
Hotrienol	5.71†	1107	[21.71]	8.82	1574	0.04
Dehydrosabinaketone	5.86	1117	0.01	8.65	1561	0.03
Unknown [m/z 82, 81 (72), 43 (64), 54 (32), 41 (20)...]	5.90	1120	0.01	9.64	1640	0.01
allo-Ocimene	6.07	1130	0.01	5.57	1332	0.01
Camphor	6.16	1136	0.06	7.20	1451	0.02
Nerol oxide	6.45	1154	0.04	6.85	1425	0.05
Borneol	6.56	1162	0.05	9.80*†	1653	[6.27]
δ-Terpineol	6.61	1165	0.01	9.55	1632	0.02

Terpinen-4-ol	6.75	1174	0.05	8.59	1556	0.06
$\alpha$ -Terpineol	6.99	1189	2.74	9.80*†	1653	[6.27]
Hodiendiol	7.10	1196	0.01	12.82	1911	0.01
Unknown [m/z 43, 71 (80), 67 (55), 59 (51), 68 (44), 41 (43)...]	7.15	1200	0.04	11.01	1753	0.01
Unknown [m/z 43, 71 (66), 59 (52), 41 (47), 68 (46)...]	7.22	1204	0.01	6.25	1381	0.01
Linalyl formate	7.40	1216	0.29	8.41†	1543	2.55
Nerol	7.62	1231	0.53	11.08	1759	0.55
Neral	7.75	1240	0.01	9.47*	1626	0.07
Geraniol	8.12*	1265	58.04	11.66	1808	1.38
Linalyl acetate	8.12*	1265	[58.04]	8.22†	1528	[77.78]
Geranial	8.20	1270	0.05	10.15	1680	0.01
Unknown [m/z 121, 43 (75), 95 (57), 41 (34), 93 (33), 69 (28)...]	8.31	1278	0.04			
Neryl formate	8.39	1283	0.06	9.47*	1626	[0.07]
Bornyl acetate	8.40	1284	0.03	8.27	1532	0.03
Thymol	8.65	1301	0.01	15.12	2130	0.01
Geranyl formate	8.70	1304	0.13	9.90	1660	0.15
Hodiendiol derivative	9.26	1340	0.05	12.96	1924	0.05
$\alpha$ -Cubebene	9.33*	1346	0.07	6.77	1419	0.03
$\alpha$ -Terpinyl acetate	9.33*	1346	[0.07]	9.71	1645	0.05
Unknown [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]	9.41	1351	0.02			
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.46	1355	0.03	11.22	1770	0.02
Neryl acetate	9.60	1365	0.83	10.20	1684	0.83
$\alpha$ -Copaene	9.68	1370	0.57	7.14	1446	0.56
$\beta$ -Bourbonene	9.78*	1378	0.18	7.48	1471	0.15
1,5-diepi- $\beta$ -Bourbonene	9.78*	1378	[0.18]	7.36	1463	0.01
Geranyl acetate	9.88*	1384	1.66	10.57	1715	1.52
$\beta$ -Cubebene	9.88*	1384	[1.66]	7.78	1494	0.15
$\beta$ -Elemene	9.92	1388	0.14	8.46*†	1546	[2.55]
$\alpha$ -Gurjunene	10.13	1402	0.01	7.67	1486	tr
$\beta$ -Caryophyllene	10.25	1411	2.14	8.46*†	1546	[2.55]
Coumarin	10.39	1422	0.04	17.18	2342	0.05
<i>trans</i> - $\alpha$ -Bergamotene	10.51	1431	0.02	8.46*†	1546	[2.55]
$\alpha$ -Humulene	10.70	1445	0.10	9.28	1610	0.10
9-epi- $\beta$ -Caryophyllene	10.87	1458	0.01	9.36	1617	0.02
$\alpha$ -Amorphene	11.09*	1474	3.49	9.58	1634	0.03
Germacrene D	11.09*	1474	[3.49]	9.79†	1651	6.27
$\beta$ -Selinene	11.14	1478	0.03	9.86	1657	0.03
Hodiendiol derivative	11.18	1480	0.08			

IV						
Bicyclogermacrene	11.29	1489	0.66	10.06*†	1673	0.66
(Z)- $\alpha$ -Bisabolene	11.39*	1497	0.09	10.37†	1698	0.23
$\alpha$ -Muurolene	11.39*	1497	[0.09]	10.06*†	1673	[0.66]
$\gamma$ -Cadinene	11.54	1508	0.11	10.42*†	1702	[0.23]
$\delta$ -Cadinene	11.67	1518	0.15	10.42*†	1702	[0.23]
<i>trans</i> -Cadina-1,4-diene	11.80	1528	0.03	10.66	1723	0.01
$\alpha$ -Calacorene	11.88	1535	0.01	12.13*	1849	0.04
Isocaryophyllene epoxide B	11.99	1543	0.02	12.13*	1849	[0.04]
Spathulenol	12.32	1569	0.08	14.42	2060	0.08
Caryophyllene oxide	12.36	1573	0.19	12.77	1907	0.25
Salvial-4(14)-en-1-one	12.52	1585	0.02	13.05	1932	0.02
Guaiol	12.62*	1593	0.10	14.15	2035	0.04
Unknown [m/z 91, 119 (91), 79 (86), 93 (85), 41 (74), 107 (68), 105 (67), 134 (65)... 220 (1)]	12.62*	1593	[0.10]			
Unknown [m/z 43, 93 (89), 91 (88), 79 (87), 123 (76), 81 (75)...]	13.09	1631	0.07	13.89	2010	0.07
$\tau$ -Cadinol	13.14	1635	0.01	14.94	2112	0.01
$\beta$ -Eudesmol	13.21	1641	0.06	15.40	2158	0.20
$\alpha$ -Eudesmol	13.25	1644	0.06	15.35	2153	0.05
$\alpha$ -Cadinol	13.29	1648	0.01	15.52	2170	0.01
Bulnesol	13.44*	1660	0.03	15.31	2148	0.02
Unknown [m/z 81, 41 (46), 79 (46), 93 (39), 91 (33), 107 (33)... 206 (8)]	13.44*	1660	[0.03]			
Phytone	15.58	1846	0.01	14.72	2089	0.02
Unknown [m/z 109, 132 (88), 157 (76), 119 (66), 91 (57), 105 (55)...]	16.50	1931	0.03			
Geranyl-para-cymene	16.70	1950	0.04	16.18	2237	0.03
Manoyl oxide	16.97	1976	0.01	16.51	2271	0.01
Manool	17.67	2044	0.02	19.35	2586	0.03
Sclareol	19.24	2204	0.48	22.90	3034	0.50
<b>Total identified</b>		<b>98.65%</b>			<b>97.97%</b>	
<b>Total reported</b>		<b>98.90%</b>			<b>98.09%</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