

Date : June 16, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20F15-PTH07

Customer identification : Palmarosa - India - P10106201R

Type : Essential oil

Source : *Cymbopogon martini*

Customer : Plant Therapy

ANALYSIS

Method: PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Sylvain Mercier, M. Sc., Chimiste

Analysis date : June 16, 2020

Checked and approved by :



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

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. 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.

PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4736 ± 0.0003 (20 °C; method PC-MAT-016)

NFT 75-234:2011 - OIL OF PALMAROSA

| Compound | Min. % | Max. % | Observed % | Complies? |
|-------------------------|--------|--------|------------|-----------|
| Geranyl caproate | 0.4 | 0.8 | 0.7 | Yes |
| (2E,6E)-Farnesol | 0.2 | 1.5 | 0.9 | Yes |
| Nerol | 0.2 | 0.5 | 0.2 | Yes |
| Geranial | 0.2 | 0.6 | 0.4 | Yes |
| Neral | | 0.5 | 0.2 | Yes |
| β-Caryophyllene | 0.7 | 2.5 | 1.9 | Yes |
| Geranyl acetate | 7 | 16 | 7 | Yes |
| Geraniol | 72 | 86 | 81 | Yes |
| Linalool | 1.0 | 5.5 | 2.7 | Yes |
| (E)-β-Ocimene | 0.5 | 3.0 | 1.5 | Yes |
| (Z)-β-Ocimene | 0.2 | 0.6 | 0.4 | Yes |
| Limonene | | 1.3 | 0.1 | Yes |
| Myrcene | | 0.5 | 0.2 | Yes |
| Refractive index | 1.4700 | 1.4780 | 1.4736 | Yes |

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the AFNOR standard for palmarosa oil.

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

| Identification | % | Class |
|---------------------------------------|-------|------------------------|
| Ethanol | tr | Aliphatic alcohol |
| 2-Methyl-3-buten-2-ol | tr | Aliphatic alcohol |
| Isovaleral | 0.01 | Aliphatic aldehyde |
| 2-Methylbutyral | tr | Aliphatic aldehyde |
| Isoamyl alcohol | 0.02 | Aliphatic alcohol |
| Hexanol | tr | Aliphatic alcohol |
| Isoamyl acetate | tr | Aliphatic ester |
| 2-Heptanone | tr | Aliphatic ketone |
| Hashishene | tr | Monoterpene |
| Tricyclene | tr | Monoterpene |
| 6-Methyl-5-hepten-2-one | 0.06 | Aliphatic ketone |
| Myrcene | 0.18 | Monoterpene |
| <i>trans</i> -Dehydroxylinalool oxide | 0.02 | Monoterpenic ether |
| <i>cis</i> -Dehydroxylinalool oxide | 0.02 | Monoterpenic ether |
| para-Cymene | 0.01 | Monoterpene |
| Limonene | 0.10 | Monoterpene |
| 1,8-Cineole | tr | Monoterpenic ether |
| (<i>Z</i>)- β -Ocimene | 0.44 | Monoterpene |
| (<i>E</i>)- β -Ocimene | 1.53 | Monoterpene |
| <i>cis</i> -Linalool oxide (fur.) | 0.02 | Monoterpenic alcohol |
| Octanol | 0.02 | Aliphatic alcohol |
| Terpinolene | 0.02 | Monoterpene |
| <i>trans</i> -Linalool oxide (fur.) | 0.01 | Monoterpenic alcohol |
| Rosefuran | 0.01 | Monoterpenic ether |
| Linalool | 2.70 | Monoterpenic alcohol |
| Nonanal | 0.04 | Aliphatic aldehyde |
| Unknown | 0.01 | Unknown |
| Camphor | 0.01 | Monoterpenic ketone |
| Citronellal | tr | Monoterpenic aldehyde |
| Nerol oxide | 0.01 | Aliphatic ether |
| Terpinen-4-ol | 0.01 | Monoterpenic alcohol |
| Menthol | 0.01 | Monoterpenic alcohol |
| α -Terpineol | 0.03 | Monoterpenic alcohol |
| Decanal | 0.03 | Aliphatic aldehyde |
| 2,3-Epoxygeranial? | 0.01 | Monoterpenic aldehyde |
| Nerol | 0.16 | Monoterpenic alcohol |
| Citronellol | 0.02 | Monoterpenic alcohol |
| Neral | 0.16 | Monoterpenic aldehyde |
| Isoamyl hexanoate | 0.02 | Aliphatic ester |
| Geraniol | 80.65 | Monoterpenic alcohol |
| Geranial | 0.36 | Monoterpenic aldehyde |
| Geranyl formate | 0.10 | Monoterpenic ester |
| 2,3-Epoxygeraniol? | 0.03 | Oxygenated monoterpene |
| Geranic acid | 0.02 | Aliphatic acid |
| Neryl acetate | 0.01 | Monoterpenic ester |

| | | |
|--|---------------|-------------------------|
| Unknown | 0.01 | Unknown |
| Geranyl acetate | 7.31 | Monoterpenic ester |
| β -Elemene | 0.09 | Sesquiterpene |
| β -Caryophyllene | 1.86 | Sesquiterpene |
| α -Guaiene | 0.02 | Sesquiterpene |
| α -Humulene | 0.14 | Sesquiterpene |
| Unknown | 0.07 | Sesquiterpene |
| β -Selinene | 0.03 | Sesquiterpene |
| Valencene | 0.05 | Sesquiterpene |
| α -Muurolene | 0.03 | Sesquiterpene |
| γ -Cadinene | 0.04 | Sesquiterpene |
| δ -Cadinene | 0.01 | Sesquiterpene |
| α -Elemol | 0.01 | Sesquiterpenic alcohol |
| Unknown | 0.02 | Unknown |
| Geranyl butyrate | 0.17 | Monoterpenic ester |
| (<i>E</i>)-Nerolidol | 0.14 | Sesquiterpenic alcohol |
| Caryophyllene oxide isomer | 0.03 | Sesquiterpenic ether |
| Caryophyllene oxide | 0.20 | Sesquiterpenic ether |
| Humulene epoxide II | 0.01 | Sesquiterpenic ether |
| Caryophylladienol II | 0.01 | Sesquiterpenic alcohol |
| (3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5 β -ol | 0.01 | Sesquiterpenic alcohol |
| (2 <i>E</i> ,6 <i>E</i>)-Farnesol | 0.91 | Sesquiterpenic alcohol |
| (2 <i>E</i> ,6 <i>E</i>)-Farnesal | 0.01 | Sesquiterpenic aldehyde |
| Geranyl caproate | 0.71 | Monoterpenic ester |
| (2 <i>E</i> ,6 <i>E</i>)-Farnesyl acetate | 0.09 | Sesquiterpenic ester |
| Phytone | 0.03 | Terpenic ketone |
| Geranyl caprylate | 0.18 | Monoterpenic ester |
| Unknown | 0.01 | Unknown |
| Unknown | 0.02 | Unknown |
| Consolidated total | 99.10% | |

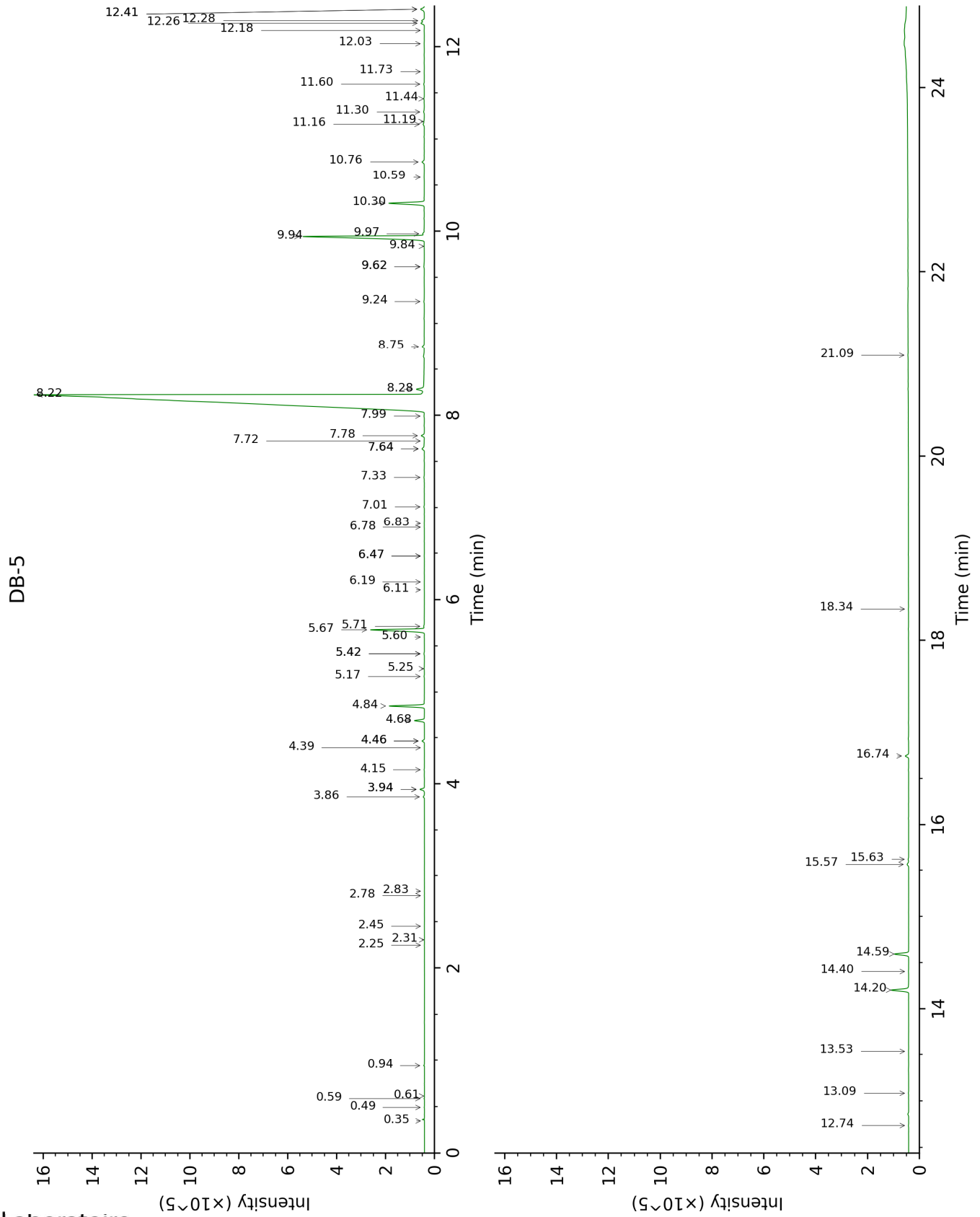
tr: The compound has been detected below 0.005% of total signal.

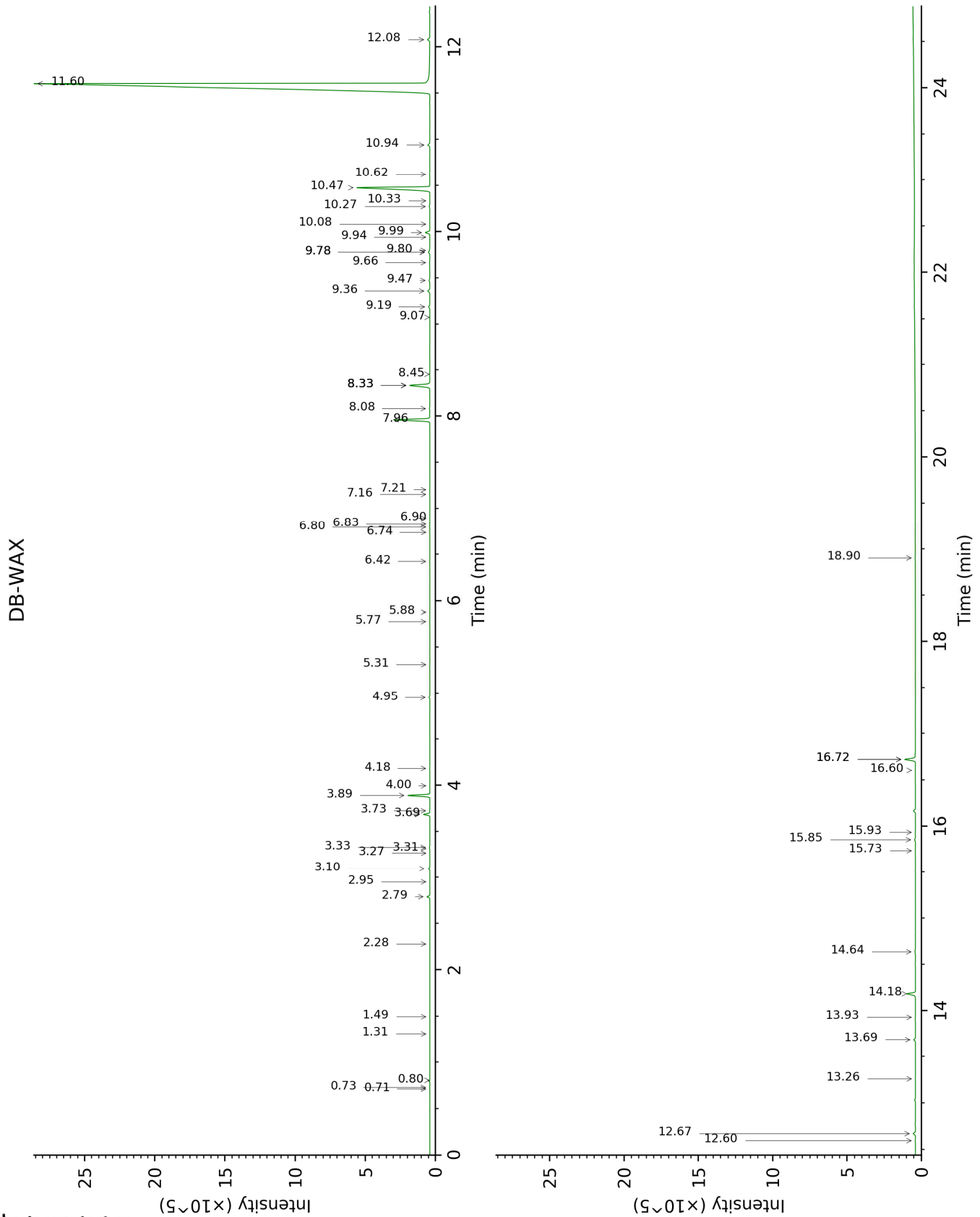
Note: no correction factor was applied

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 | % |
| Ethanol | 0.35 | 522 | tr | 0.80 | 907 | tr |
| 2-Methyl-3-buten-2-ol | 0.49 | 588 | tr | 1.49 | 1011 | 0.01 |
| Isovaleral | 0.59 | 641 | 0.01 | 0.73 | 884 | 0.01 |
| 2-Methylbutyral | 0.61 | 652 | tr | 0.71 | 878 | tr |
| Isoamyl alcohol | 0.94 | 737 | 0.02 | 3.33 | 1174 | 0.02 |
| Hexanol | 2.25 | 874 | tr | 5.31 | 1317 | 0.01 |
| Isoamyl acetate | 2.31 | 878 | tr | 2.28 | 1089 | 0.01 |
| 2-Heptanone | 2.45 | 890 | tr | 2.95 | 1144 | tr |
| Hashishene | 2.78 | 915 | tr | 1.31 | 988 | tr |
| Tricyclene | 2.83 | 918 | tr | | | |
| 6-Methyl-5-hepten-2-one | 3.86 | 986 | 0.06 | 4.95 | 1296 | 0.06 |
| Myrcene | 3.94* | 991 | 0.20 | 2.79 | 1132 | 0.18 |
| <i>trans</i> -Dehydroxylinalool oxide | 3.94* | 991 | [0.20] | 3.32 | 1173 | 0.02 |
| <i>cis</i> -Dehydroxylinalool oxide | 4.15 | 1005 | 0.02 | 3.72 | 1205 | 0.02 |
| para-Cymene | 4.39 | 1020 | 0.01 | 4.00 | 1225 | 0.01 |
| Limonene | 4.46* | 1025 | 0.11 | 3.10 | 1156 | 0.10 |
| 1,8-Cineole | 4.46* | 1025 | [0.11] | 3.27 | 1169 | tr |
| (<i>Z</i>)- β -Ocimene | 4.68 | 1039 | 0.44 | 3.69 | 1202 | 0.43 |
| (<i>E</i>)- β -Ocimene | 4.84 | 1049 | 1.53 | 3.89 | 1218 | 1.52 |
| <i>cis</i> -Linalool oxide (fur.) | 5.17 | 1069 | 0.02 | 6.42 | 1398 | 0.02 |
| Octanol | 5.25 | 1074 | 0.02 | 8.08 | 1523 | 0.04 |
| Terpinolene | 5.42* | 1085 | 0.03 | 4.18 | 1239 | 0.02 |
| <i>trans</i> -Linalool oxide (fur.) | 5.42* | 1085 | [0.03] | 6.80 | 1426 | 0.01 |
| Rosefuran | 5.60 | 1096 | 0.01 | 5.88 | 1358 | 0.01 |
| Linalool | 5.67 | 1101 | 2.70 | 7.96 | 1513 | 2.72 |
| Nonanal | 5.71 | 1104 | 0.04 | 5.77 | 1351 | 0.02 |
| Unknown [m/z 95, 123 (73), 67 (64), 82 (54), 41 (47), 55 (27)...] | 6.11 | 1129 | 0.01 | | | |
| Camphor | 6.19 | 1135 | 0.01 | 7.16 | 1452 | 0.02 |
| Citronellal | 6.47* | 1153 | 0.01 | 6.90 | 1433 | tr |
| Nerol oxide | 6.47* | 1153 | [0.01] | 6.74 | 1421 | 0.01 |
| Terpinen-4-ol | 6.78 | 1173 | 0.01 | 8.45 | 1551 | tr |
| Menthol | 6.83 | 1176 | 0.01 | 9.07 | 1600 | 0.01 |
| α -Terpineol | 7.01 | 1188 | 0.03 | 9.66 | 1648 | 0.03 |
| Decanal | 7.33 | 1209 | 0.03 | 7.21 | 1456 | 0.01 |
| 2,3-Epoxygeranial? | 7.64* | 1231 | 0.17 | | | |
| Nerol | 7.64* | 1231 | [0.17] | 10.94 | 1754 | 0.16 |

| | | | | | | |
|---|--------|------|---------|--------|------|--------|
| Citronellol | 7.72 | 1236 | 0.02 | 10.62 | 1727 | 0.03 |
| Neral | 7.78 | 1240 | 0.16 | 9.36 | 1623 | 0.18 |
| Isoamyl hexanoate | 7.99 | 1255 | 0.02 | 6.83 | 1428 | 0.02 |
| Geraniol | 8.22† | 1271 | 81.10 | 11.60 | 1811 | 80.65 |
| Geranial | 8.28† | 1275 | [81.10] | 9.99 | 1674 | 0.36 |
| Geranyl formate | 8.75 | 1308 | 0.10 | 9.80 | 1659 | 0.02 |
| 2,3-Epoxygeraniol? | 9.24 | 1338 | 0.03 | | | |
| Geranic acid | 9.62* | 1364 | 0.05 | 16.60 | 2292 | 0.02 |
| Neryl acetate | 9.62* | 1364 | [0.05] | 10.08 | 1682 | 0.01 |
| Unknown [m/z 43, 41 (25), 67 (24), 109 (23), 93 (20), 69 (19)...] | 9.84 | 1380 | 0.01 | | | |
| Geranyl acetate | 9.94 | 1387 | 7.31 | 10.47 | 1714 | 7.32 |
| β-Elemene | 9.97 | 1389 | 0.09 | 8.33* | 1542 | 1.88 |
| β-Caryophyllene | 10.30 | 1413 | 1.86 | 8.33* | 1542 | [1.88] |
| α-Guaiene | 10.58 | 1434 | 0.02 | 8.33* | 1542 | [1.88] |
| α-Humulene | 10.76 | 1447 | 0.14 | 9.19 | 1609 | 0.12 |
| Unknown [m/z 189, 133 (75), 91 (71), 105 (69), 93 (44)... 204 (33)] | 11.16 | 1477 | 0.07 | 9.47 | 1632 | 0.08 |
| β-Selinene | 11.19 | 1480 | 0.03 | 9.78* | 1657 | 0.13 |
| Valencene | 11.30 | 1487 | 0.05 | 9.78* | 1657 | [0.13] |
| α-Muurolene | 11.44 | 1498 | 0.03 | 9.94 | 1670 | 0.02 |
| γ-Cadinene | 11.60 | 1510 | 0.04 | 10.27 | 1697 | 0.06 |
| δ-Cadinene | 11.73 | 1520 | 0.01 | 10.33 | 1702 | 0.01 |
| α-Elemol | 12.03 | 1544 | 0.01 | 13.93 | 2023 | 0.02 |
| Unknown [m/z 59, 68 (63), 43 (31), 67 (27), 81 (27), 94 (25), 69 (23), 41 (22), 84 (20)...] | 12.18 | 1556 | 0.02 | | | |
| Geranyl butyrate | 12.26 | 1562 | 0.17 | 12.08 | 1853 | 0.18 |
| (E)-Nerolidol | 12.28 | 1564 | 0.14 | 13.69 | 2000 | 0.14 |
| Caryophyllene oxide isomer | 12.41* | 1574 | 0.22 | 12.60 | 1899 | 0.03 |
| Caryophyllene oxide | 12.41* | 1574 | [0.22] | 12.67 | 1906 | 0.20 |
| Humulene epoxide II | 12.74 | 1600 | 0.01 | 13.26 | 1960 | 0.01 |
| Caryophylladienol II | 13.08 | 1628 | 0.01 | 15.93 | 2222 | 0.02 |
| (3Z)-Caryophylla-3,8(13)-dien-5β-ol | 13.53 | 1665 | 0.01 | 16.72* | 2304 | 0.92 |
| (2E,6E)-Farnesol | 14.20 | 1721 | 0.91 | 16.72* | 2304 | [0.92] |
| (2E,6E)-Farnesal | 14.40 | 1739 | 0.01 | 15.73 | 2201 | 0.02 |
| Geranyl caproate | 14.59 | 1755 | 0.71 | 14.18 | 2048 | 0.73 |
| (2E,6E)-Farnesyl acetate | 15.57 | 1842 | 0.09 | 15.85 | 2214 | 0.09 |

| | | | | | | |
|---|-------|---------------|------|-------|---------------|------|
| Phytone | 15.63 | 1847 | 0.03 | 14.64 | 2092 | 0.08 |
| Geranyl caprylate | 16.74 | 1951 | 0.18 | | | |
| Unknown [m/z 69, 41 (37), 81 (23), 95 (19), 109 (18)...] | 18.34 | 2108 | 0.01 | 18.90 | 2547 | 0.03 |
| Unknown [m/z 69, 81 (54), 95 (26), 41 (20), 82 (16), 123 (16)...] | 21.09 | 2406 | 0.02 | | | |
| Total identified | | 99.06% | | | 98.78% | |
| Total reported | | 99.20% | | | 98.89% | |

*: 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