

Date : May 10, 2022

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 22E04-PTH02


Customer identification : Vetiver ORGANIC - Madagascar - V80107R

Type : Essential oil

Source : *Vetiveria zizanioides*

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

Analysis date : May 06, 2022

Checked and approved by :

Alexis St-Gelais, Ph. D., 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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: Light brown liquid

Refractive index: 1.5262 ± 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 |
|--|------|--------------------------|
| Furfural | 0.06 | Furan |
| Unknown | 0.06 | Sesquiterpene |
| 2-Norprezizene | 0.06 | Sesquiterpene |
| Unknown | 0.14 | Unknown |
| Unknown | 0.21 | Norsesquiterpene |
| Cyclosativene II | 0.01 | Sesquiterpene |
| 12-Norisoziza-5-ene | 0.95 | Norsesquiterpene |
| Unknown | 0.27 | Norsesquiterpene |
| α -Ylangene | 0.06 | Sesquiterpene |
| 6-epi-Nigritene | 1.43 | Norsesquiterpene |
| Nigritene | 2.76 | Norsesquiterpene |
| Unknown | 0.23 | Unknown |
| Acora-3,7(14)-diene | 0.13 | Sesquiterpene |
| β -Funebrene | 0.14 | Sesquiterpene |
| β -Cedrene | 0.16 | Sesquiterpene |
| Unknown | 0.86 | Norsesquiterpene |
| Prezizaene | 0.47 | Sesquiterpene |
| Khusimene | 0.47 | Sesquiterpene |
| (E)-Isoeugenol | 0.22 | Phenylpropanoid |
| Unknown | 0.40 | Sesquiterpene |
| Unknown | 0.26 | Sesquiterpene |
| Unknown | 0.44 | Sesquiterpene |
| α -Amorphene | 1.12 | Sesquiterpene |
| α -Vetispirene | 1.18 | Sesquiterpene |
| β -Vetispirene | 0.91 | Sesquiterpene |
| γ -Amorphene | 0.10 | Sesquiterpene |
| δ -Selinene | 0.84 | Sesquiterpene |
| Eudesma-2,4(15),11-triene | 0.16 | Sesquiterpene |
| δ -Amorphene | 0.61 | Sesquiterpene |
| Nootkatene | 0.37 | Sesquiterpene |
| Spirovetiva-1(10),7(11)-diene | 0.57 | Sesquiterpene |
| <i>trans</i> -Calamenene | 0.10 | Sesquiterpene |
| δ -Cadinene | 0.34 | Sesquiterpene |
| γ -Vetivenene | 2.03 | Sesquiterpene |
| α -Calacorene | 0.45 | Sesquiterpene |
| β -Vetivenene | 2.98 | Sesquiterpene |
| α -Elemol | 0.20 | Sesquiterpenic alcohol |
| Eremophila-1(10),11-dien-9 β -ol | 1.47 | Sesquiterpenic alcohol |
| Unknown | 0.27 | Oxygenated sesquiterpene |
| Gynuradienol? | 0.33 | Sesquiterpenic alcohol |
| Unknown | 0.86 | Sesquiterpene |
| Khusimone | 0.90 | Norsesquiterpenic ketone |
| Selin-6-en-4 α -ol isomer | 0.38 | Sesquiterpenic alcohol |
| Junenol | 0.46 | Sesquiterpenic alcohol |
| Unknown | 1.06 | Sesquiterpene |

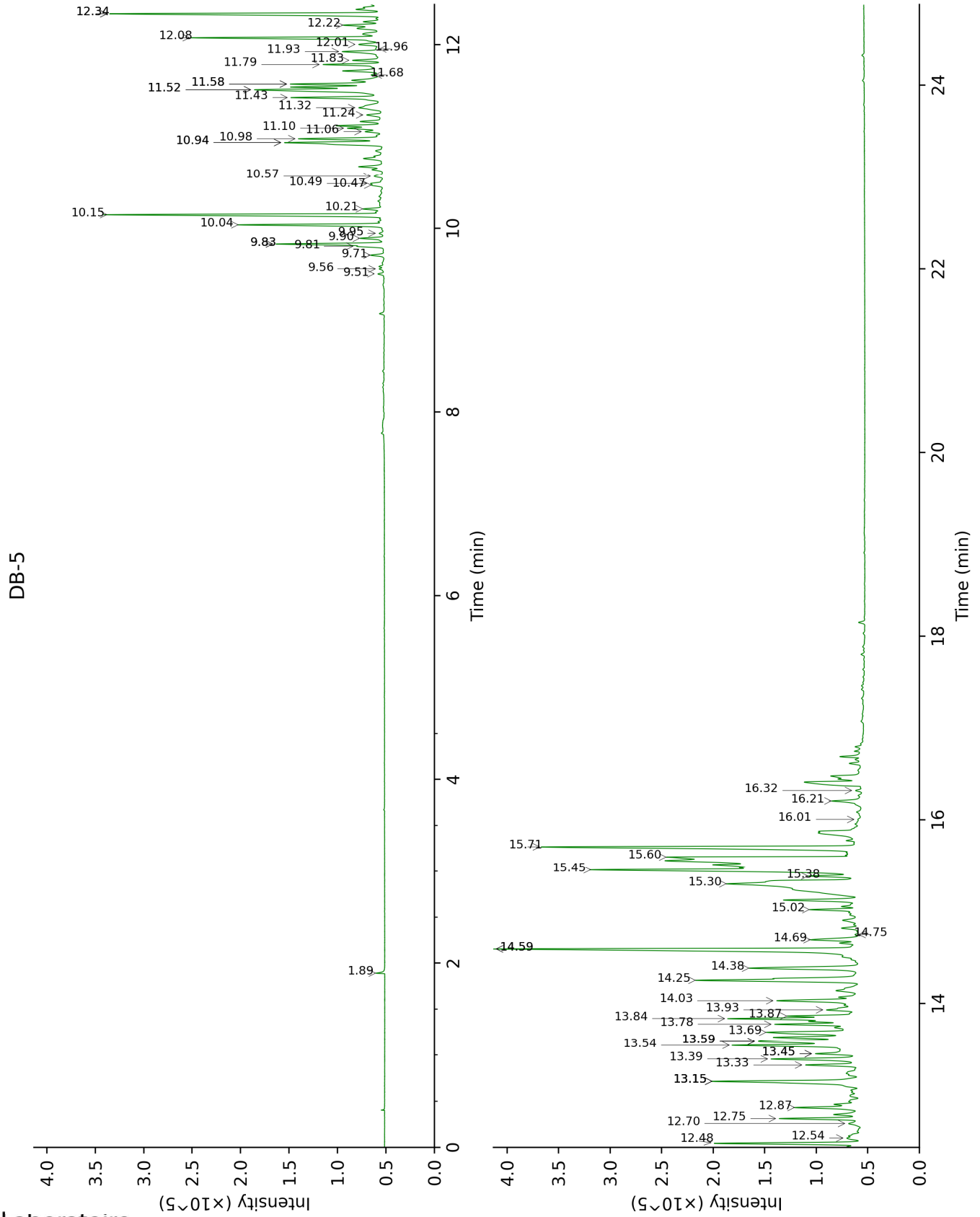
| | | |
|----------------------------------|---------------|--------------------------|
| 10-epi- γ -Eudesmol | 0.49 | Sesquiterpenic alcohol |
| γ -Eudesmol | 0.71 | Sesquiterpenic alcohol |
| Unknown | 1.24 | Unknown |
| Unknown | 0.38 | Oxygenated sesquiterpene |
| Unknown | 0.36 | Unknown |
| Unknown | 1.79 | Oxygenated sesquiterpene |
| Unknown | 1.65 | Unknown |
| Unknown | 0.36 | Sesquiterpenic alcohol |
| Cyclocopacamphan-12-ol, epimer A | 0.87 | Sesquiterpenic alcohol |
| Cyclocopacamphan-12-ol, epimer B | 1.64 | Sesquiterpenic alcohol |
| Zizanol | 0.97 | Sesquiterpenic alcohol |
| Khusiol | 1.46 | Sesquiterpenic alcohol |
| epi-Zizanone | 0.77 | Sesquiterpenic ketone |
| Zizanal | 0.46 | Sesquiterpenic aldehyde |
| Unknown | 1.30 | Oxygenated sesquiterpene |
| Unknown | 2.14 | Oxygenated sesquiterpene |
| Vetiselinenol | 1.77 | Sesquiterpenic alcohol |
| Khusimol | 4.91 | Sesquiterpenic alcohol |
| Unknown | 0.68 | Oxygenated sesquiterpene |
| 10-epi-Acora-3,11-dien-15-al? | 0.78 | Sesquiterpenic aldehyde |
| Unknown | 0.11 | Oxygenated sesquiterpene |
| Unknown | 0.58 | Unknown |
| Isozizanoic acid | 6.05 | Sesquiterpenic acid |
| (Z)-Isovalencenal | 0.63 | Sesquiterpenic aldehyde |
| β -Vetivone | 2.21 | Sesquiterpenic ketone |
| Zizanoic acid | 9.01 | Sesquiterpenic acid |
| α -Vetivone | 4.31 | Sesquiterpenic ketone |
| (E)-Isovalencenyl acetate? | 0.08 | Sesquiterpenic ester |
| Isovalencenal isomer II? | 0.58 | Sesquiterpenic aldehyde |
| Isovalencenal isomer I? | 0.10 | Sesquiterpenic aldehyde |
| Consolidated total | 75.82% | |

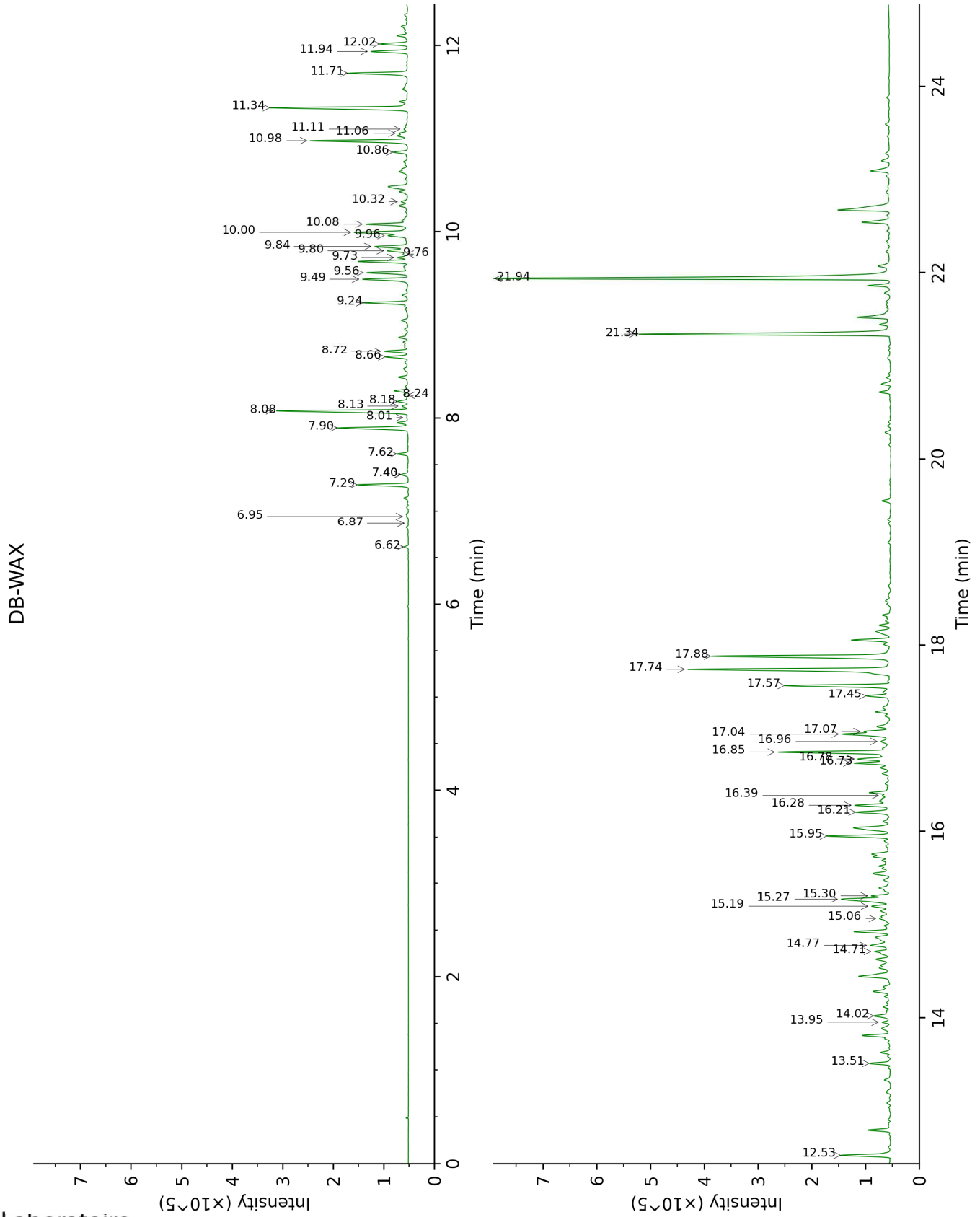
Note: no correction factor was applied

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 | % |
| Furfural | 1.89 | 826 | 0.06 | 6.62 | 1414 | 0.08 |
| Unknown [m/z 120, 91 (31), 92 (23), 121 (10), 105 (9), 119 (6)...202 (1)] | 9.51 | 1337 | 0.06 | | | |
| 2-Norprezizene | 9.56 | 1341 | 0.06 | 7.40* | 1471 | 0.17 |
| Unknown [m/z 119, 91 (23), 120 (17), 118 (11), 92 (7), 105 (6)...] | 9.71 | 1352 | 0.14 | 7.40* | 1471 | [0.17] |
| Unknown [m/z 145, 188 (95), 117 (91), 173 (80), 91 (65), 131 (64)] | 9.81 | 1358 | 0.21 | | | |
| Cyclosativene II | 9.83* | 1360 | 1.05 | 6.87 | 1432 | 0.01 |
| 12-Norisoziza-5-ene | 9.83* | 1360 | [1.05] | 7.29 | 1463 | 0.95 |
| Unknown [m/z 119, 147 (85), 161 (75), 91 (69), 105 (62), 134 (60), 190 (43)] | 9.90 | 1365 | 0.27 | 7.62 | 1488 | 0.22 |
| α -Ylangene | 9.95 | 1368 | 0.06 | 6.95 | 1438 | 0.04 |
| 6-epi-Nigritene | 10.04 | 1375 | 1.43 | 7.90 | 1509 | 1.51 |
| Nigritene | 10.15 | 1383 | 2.76 | 8.08 | 1523 | 2.77 |
| Unknown [m/z 119, 91 (24), 120 (17), 118 (10), 92 (8), 41 (7), 105 (6)...] | 10.22 | 1387 | 0.23 | 8.18 | 1531 | 0.24 |
| Acora-3,7(14)-diene | 10.47 | 1406 | 0.13 | 8.13 | 1527 | 0.14 |
| β -Funebrene | 10.49 | 1407 | 0.14 | 8.01 | 1517 | 0.04 |
| β -Cedrene | 10.57 | 1413 | 0.16 | 8.24 | 1536 | 0.10 |
| Unknown [m/z 175, 190 (73), 161 (65), 119 (40), 105 (35), 91 (28), 133 (23)] | 10.94*† | 1440 | 2.28 | 9.24 | 1614 | 0.86 |
| Prezizaene | 10.94*† | 1440 | [2.28] | 8.66 | 1568 | 0.47 |
| Khusimene | 10.98† | 1444 | [2.28] | 8.72 | 1572 | 0.47 |
| (E)-Isoeugenol | 11.06 | 1449 | 0.22 | 16.38 | 2270 | 0.16 |
| Unknown [m/z 119, 190 (99), 175 (95), 105 (71), 91 (59), 120 (57)... 204 (2)] | 11.10 | 1452 | 0.40 | | | |
| Unknown [m/z 119, 120 (31), 83 (23), 105 (22), 91 (21), 81 (18)... 202 (9)] | 11.24 | 1463 | 0.26 | 9.73 | 1653 | 0.20 |
| Unknown [m/z 145, 202 (85), 159 (64), 187 (39), 131 (35), 117 (34)] | 11.32 | 1469 | 0.44 | 9.80 | 1659 | 0.49 |

| | | | | | | |
|---|--------|------|--------|-------|------|------|
| α-Amorphene | 11.43 | 1477 | 1.12 | 9.49 | 1634 | 0.96 |
| α-Vetispirene | 11.52* | 1483 | 2.03 | 10.00 | 1675 | 1.18 |
| β-Vetispirene | 11.52* | 1483 | [2.03] | 10.08 | 1682 | 0.91 |
| γ-Amorphene | 11.58* | 1488 | 1.00 | 9.76 | 1656 | 0.10 |
| δ-Selinene | 11.58* | 1488 | [1.00] | 9.56 | 1640 | 0.84 |
| Eudesma-2,4(15),11-triene | 11.68 | 1495 | 0.16 | 11.06 | 1764 | 0.18 |
| δ-Amorphene | 11.79 | 1504 | 0.61 | 9.84 | 1662 | 0.74 |
| Nootkatene | 11.83 | 1507 | 0.37 | 10.86 | 1747 | 0.32 |
| Spirovetiva-1(10),7(11)-diene | 11.93 | 1515 | 0.57 | 9.96 | 1672 | 0.41 |
| trans-Calamenene | 11.96 | 1517 | 0.10 | 11.11 | 1768 | 0.10 |
| δ-Cadinene | 12.01 | 1521 | 0.34 | 10.32 | 1702 | 0.16 |
| γ-Vetivenene | 12.08 | 1526 | 2.03 | 10.98 | 1758 | 2.03 |
| α-Calacorene | 12.22 | 1537 | 0.45 | 12.02 | 1848 | 0.58 |
| β-Vetivenene | 12.34* | 1547 | 3.04 | 11.34 | 1787 | 2.98 |
| α-Elemol | 12.34* | 1547 | [3.04] | 13.95 | 2026 | 0.20 |
| Eremophila-1(10),11-dien-9β-ol | 12.48 | 1558 | 1.47 | 11.70 | 1820 | 1.26 |
| Unknown [m/z 81, 200 (55), 143 (36), 93 (33), 91 (32), 185 (31), 129 (27), 128 (21)...] | 12.54 | 1563 | 0.27 | | | |
| Gynuradienol? | 12.70 | 1575 | 0.33 | | | |
| Unknown [m/z 202, 187 (63), 145 (43), 159 (34), 131 (29), 91 (22), 117 (20)] | 12.75 | 1579 | 0.86 | 11.94 | 1840 | 0.76 |
| Khusimone | 12.87 | 1589 | 0.90 | | | |
| Selin-6-en-4α-ol isomer | 13.15* | 1611 | 2.36 | 14.71 | 2098 | 0.38 |
| Junenol | 13.15* | 1611 | [2.36] | 13.51 | 1983 | 0.46 |
| Unknown [m/z 187, 202 (86), 145 (25), 131 (19), 105 (16), 188 (15)] | 13.15* | 1611 | [2.36] | 12.53 | 1893 | 1.06 |
| 10-epi-γ-Eudesmol | 13.15* | 1611 | [2.36] | 14.02 | 2032 | 0.49 |
| γ-Eudesmol | 13.33 | 1626 | 0.71 | 14.77 | 2105 | 0.64 |
| Unknown [m/z 145, 59 (97), 161 (87), 218 (76), 43 (76), 179 (63)...] | 13.39 | 1631 | 1.24 | | | |
| Unknown [m/z 187, 93 (35), 81 (34), 79 (31), 41 (30), 91 (30), 107 (29)... 220 (4)] | 13.45* | 1636 | 0.74 | 15.30 | 2158 | 0.38 |
| Unknown [m/z 43, 91 (87), 71 (83), 93 (77), 95 (75), 135 (74)...] | 13.45* | 1636 | [0.74] | | | |

| | | | | | | |
|---|---------|------|---------|-------|------|------|
| Unknown [m/z 121, 107 (69), 93 (64), 79 (60), 177 (59), 136 (58), 91 (57), 41 (56)... 220 (21)] | 13.54 | 1644 | 1.79 | 15.27 | 2155 | 1.54 |
| Unknown [m/z 159, 91 (58), 105 (54), 93 (51), 81 (50), 177 (44)...] | 13.59*† | 1647 | 2.88 | | | |
| Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)] | 13.59*† | 1647 | [2.88] | 15.06 | 2134 | 0.36 |
| Cyclocopacamphan-12-ol, epimer A | 13.59*† | 1647 | [2.88] | 16.21 | 2251 | 0.87 |
| Cyclocopacamphan-12-ol, epimer B | 13.69 | 1656 | 1.64 | 16.28 | 2259 | 0.79 |
| Zizanol | 13.78 | 1663 | 0.97 | 16.73 | 2307 | 0.79 |
| Khusiol | 13.84 | 1668 | 1.46 | 15.95 | 2225 | 1.32 |
| epi-Zizanone | 13.86 | 1670 | 0.77 | 15.19 | 2147 | 0.47 |
| Zizanal | 13.93 | 1676 | 0.46 | 17.07 | 2343 | 0.48 |
| Unknown [m/z 145, 147 (98), 105 (93), 159 (91), 91 (90), 119 (76)...220 (30)] | 14.03 | 1684 | 1.30 | | | |
| Unknown [m/z 189, 159 (82), 133 (44), 91 (29), 105 (29), 205 (25)... 220 (13)] | 14.25 | 1702 | 2.14 | 16.85 | 2319 | 2.40 |
| Vetiselinenol | 14.38 | 1714 | 1.77 | 17.04 | 2340 | 1.29 |
| Khusimol | 14.59*† | 1732 | 5.58 | 17.74 | 2417 | 4.91 |
| Unknown [m/z 189, 187 (29), 159 (23), 43 (20), 133 (16)...] | 14.59*† | 1732 | [5.58] | | | |
| 10-epi-Acora-3,11-dien-15-al? | 14.69 | 1740 | 0.78 | | | |
| Unknown [m/z 91, 105 (89), 79 (84), 93 (77), 107 (67), 189 (64), 145 (62), 119 (61)... 220 (16)...] | 14.75 | 1745 | 0.11 | | | |
| Unknown [m/z 174, 131 (37), 159 (25), 91 (20), 175 (14)...] | 15.02 | 1769 | 0.58 | 17.45 | 2384 | 0.54 |
| Isozizanoic acid | 15.30 | 1793 | 6.05 | 21.34 | 2848 | 5.26 |
| (Z)-Isovalencenal | 15.38 | 1800 | 0.63 | 16.96 | 2332 | 0.34 |
| β-Vetivone | 15.45† | 1806 | 13.02 | 17.57 | 2397 | 2.21 |
| Zizanoic acid | 15.60† | 1819 | [13.02] | 21.94 | 2926 | 9.01 |
| α-Vetivone | 15.71 | 1829 | 4.31 | 17.88 | 2432 | 4.16 |

| | | | | | | |
|----------------------------|-------|---------------|------|-------|---------------|------|
| (E)-Isovalencenyl acetate? | 16.01 | 1856 | 0.08 | 16.78 | 2311 | 0.79 |
| Isovalencenal isomer II? | 16.21 | 1875 | 0.58 | | | |
| Isovalencenal isomer I? | 16.32 | 1885 | 0.10 | | | |
| Total identified | | 67.73% | | | 54.49% | |
| Total reported | | 78.02% | | | 63.52% | |

*: 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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index