

**Date :** March 09, 2023

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 23C02-PTH01

**Customer identification :** Oregano ORGANIC - Greece - O50113R

**Type :** Essential oil

**Source :** *Origanum vulgare* ct. Carvacrol

**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 :** Amélie Simard, Analyste

**Analysis date :** March 07, 2023

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow liquid

**Refractive index:**  $1.5113 \pm 0.0003$  (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                          | tr   | Aliphatic aldehyde   |
| Methyl 2-methylbutyrate             | tr   | Aliphatic ester      |
| (2E)-Hexenal                        | 0.01 | Aliphatic aldehyde   |
| (3Z)-Hexenol                        | 0.01 | Aliphatic alcohol    |
| Hashishene                          | 0.01 | Monoterpene          |
| Tricyclene                          | 0.02 | Monoterpene          |
| $\alpha$ -Thujene                   | 0.53 | Monoterpene          |
| $\alpha$ -Pinene                    | 0.64 | Monoterpene          |
| Camphene                            | 0.23 | Monoterpene          |
| $\alpha$ -Fenchene                  | 0.01 | Monoterpene          |
| Thuja-2,4(10)-diene                 | 0.01 | Monoterpene          |
| $\beta$ -Pinene                     | 0.72 | Monoterpene          |
| Sabinene                            | 0.01 | Monoterpene          |
| Unknown                             | 0.03 | Monoterpene          |
| Octen-3-ol                          | 0.45 | Aliphatic alcohol    |
| Octan-3-one                         | 0.22 | Aliphatic ketone     |
| Myrcene                             | 1.21 | Monoterpene          |
| $\alpha$ -Phellandrene              | 0.02 | Monoterpene          |
| Pseudolimonene                      | 0.03 | Monoterpene          |
| <i>cis</i> -Dehydroxylinalool oxide | 0.01 | Monoterpenic ether   |
| $\Delta^3$ -Carene                  | 0.02 | Monoterpene          |
| $\alpha$ -Terpinene                 | 1.08 | Monoterpene          |
| meta-Cymene                         | 0.03 | Monoterpene          |
| para-Cymene                         | 5.78 | Monoterpene          |
| Limonene                            | 0.76 | Monoterpene          |
| 1,8-Cineole                         | 1.15 | Monoterpenic ether   |
| ortho-Cymene                        | 0.02 | Monoterpene          |
| (Z)- $\beta$ -Ocimene               | 0.01 | Monoterpene          |
| (E)- $\beta$ -Ocimene               | 0.02 | Monoterpene          |
| $\gamma$ -Terpinene                 | 4.06 | Monoterpene          |
| <i>cis</i> -Sabinene hydrate        | 0.03 | Monoterpenic alcohol |
| <i>cis</i> -Linalool oxide (fur.)   | 0.02 | Monoterpenic alcohol |
| Octanol                             | 0.01 | Aliphatic alcohol    |
| <i>trans</i> -Linalool oxide (fur.) | tr   | Monoterpenic alcohol |
| Terpinolene                         | 0.02 | Monoterpene          |
| <i>trans</i> -Sabinene hydrate      | 0.02 | Monoterpenic alcohol |
| Linalool                            | 2.83 | Monoterpenic alcohol |
| Hotrienol                           | 0.01 | Monoterpenic alcohol |
| <i>cis</i> -para-Menth-2-en-1-ol    | 0.01 | Monoterpenic alcohol |
| Camphor                             | 0.63 | Monoterpenic ketone  |
| Isoborneol                          | 0.01 | Monoterpenic alcohol |
| Unknown                             | 0.01 | Unknown              |
| Borneol                             | 1.12 | Monoterpenic alcohol |
| <i>trans</i> -2-Caren-4-ol?         | 0.01 | Monoterpenic alcohol |
| Terpinen-4-ol                       | 0.65 | Monoterpenic alcohol |

|                                                        |               |                        |
|--------------------------------------------------------|---------------|------------------------|
| α-Terpineol                                            | 0.39          | Monoterpenic alcohol   |
| Myrtenal                                               | 0.03          | Monoterpenic aldehyde  |
| cis-Dihydrocarvone                                     | 0.40          | Monoterpenic ketone    |
| trans-Piperitol                                        | 0.01          | Monoterpenic alcohol   |
| Thymol methyl ether analog I (isothymol methyl ether?) | 0.01          | Monoterpenic ether     |
| Carvacrol methyl ether                                 | 0.23          | Monoterpenic ether     |
| Geraniol                                               | 0.01          | Monoterpenic alcohol   |
| Linalyl acetate                                        | 0.01          | Monoterpenic ester     |
| Bornyl acetate                                         | 0.01          | Monoterpenic ester     |
| Thymol analogue I (isothymol?)                         | 0.01          | Monoterpenic alcohol   |
| Thymol                                                 | 2.06          | Monoterpenic alcohol   |
| Carvacrol                                              | 70.27         | Monoterpenic alcohol   |
| 2-Methyl-6-propylphenol?                               | 0.05          | Miscellaneous          |
| α-Terpinyl acetate                                     | 0.04          | Monoterpenic ester     |
| Eugenol                                                | 0.13          | Phenylpropanoid        |
| α-Copaene                                              | 0.03          | Sesquiterpene          |
| Geranyl acetate                                        | 0.01          | Monoterpenic ester     |
| β-Elemene                                              | 0.01          | Sesquiterpene          |
| Methyleugenol                                          | 0.02          | Phenylpropanoid        |
| β-Caryophyllene                                        | 2.38          | Sesquiterpene          |
| β-Copaene                                              | 0.01          | Sesquiterpene          |
| 9-epi-Isocaryophyllene                                 | 0.06          | Sesquiterpene          |
| α-Humulene                                             | 0.58          | Sesquiterpene          |
| (E)-β-Farnesene                                        | 0.01          | Sesquiterpene          |
| allo-Aromadendr-9-ene                                  | 0.01          | Sesquiterpene          |
| Viridiflorene                                          | 0.01          | Sesquiterpene          |
| (3Z,6E)-α-Farnesene                                    | 0.01          | Sesquiterpene          |
| β-Bisabolene                                           | 0.04          | Sesquiterpene          |
| δ-Cadinene                                             | 0.01          | Sesquiterpene          |
| Caryophyllene oxide isomer                             | 0.02          | Sesquiterpenic ether   |
| Caryophyllene oxide                                    | 0.08          | Sesquiterpenic ether   |
| Humulene epoxide II                                    | 0.02          | Sesquiterpenic ether   |
| (3Z)-Caryophylla-3,8(13)-dien-5β-ol                    | 0.01          | Sesquiterpenic alcohol |
| Unknown                                                | 0.02          | Unknown                |
| Unknown                                                | 0.02          | Unknown                |
| Unknown                                                | 0.01          | Unknown                |
| meta-Camphorene                                        | 0.01          | Diterpene              |
| Unknown                                                | 0.01          | Unknown                |
| Unknown                                                | 0.02          | Unknown                |
| <b>Consolidated total</b>                              | <b>99.54%</b> |                        |

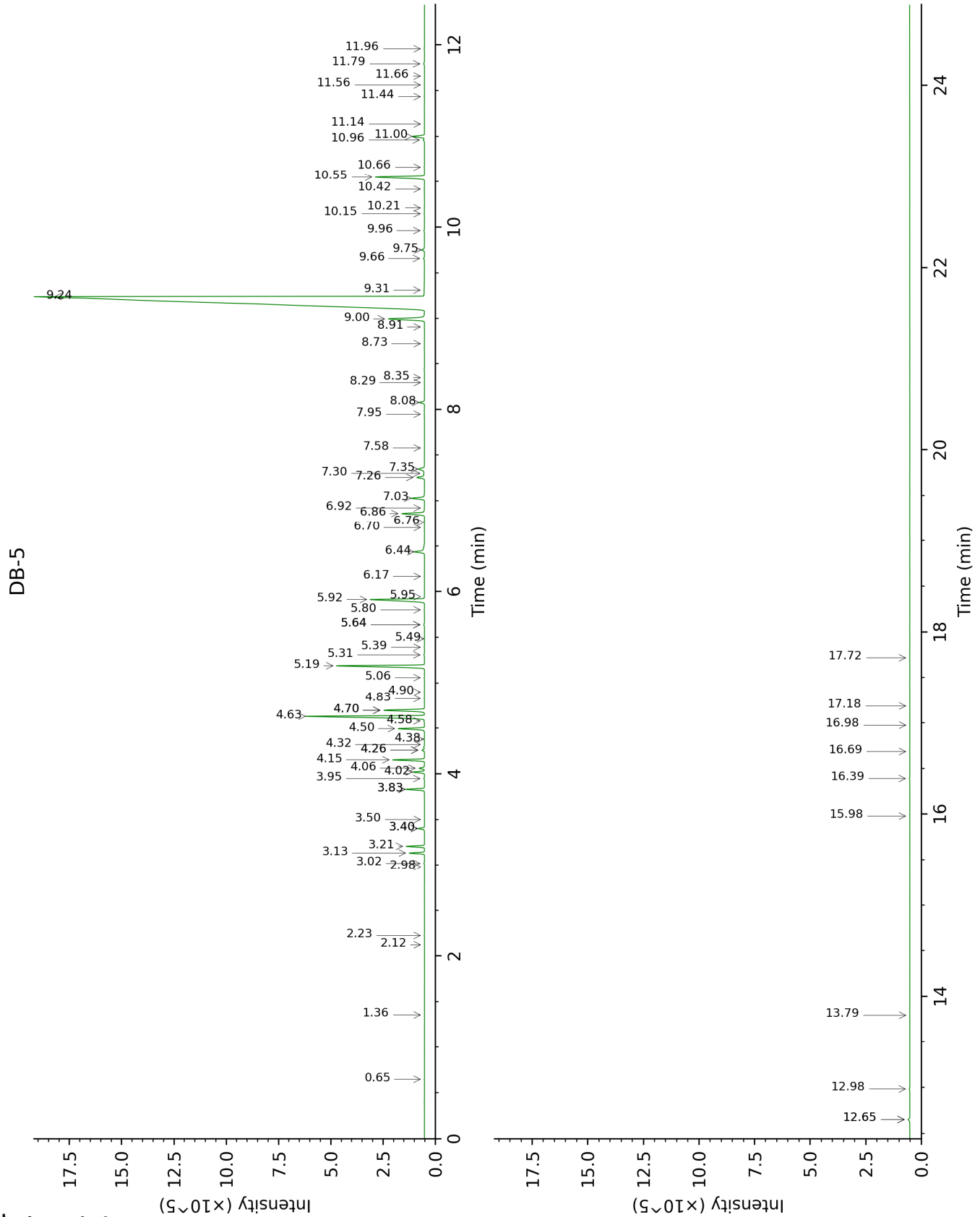
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

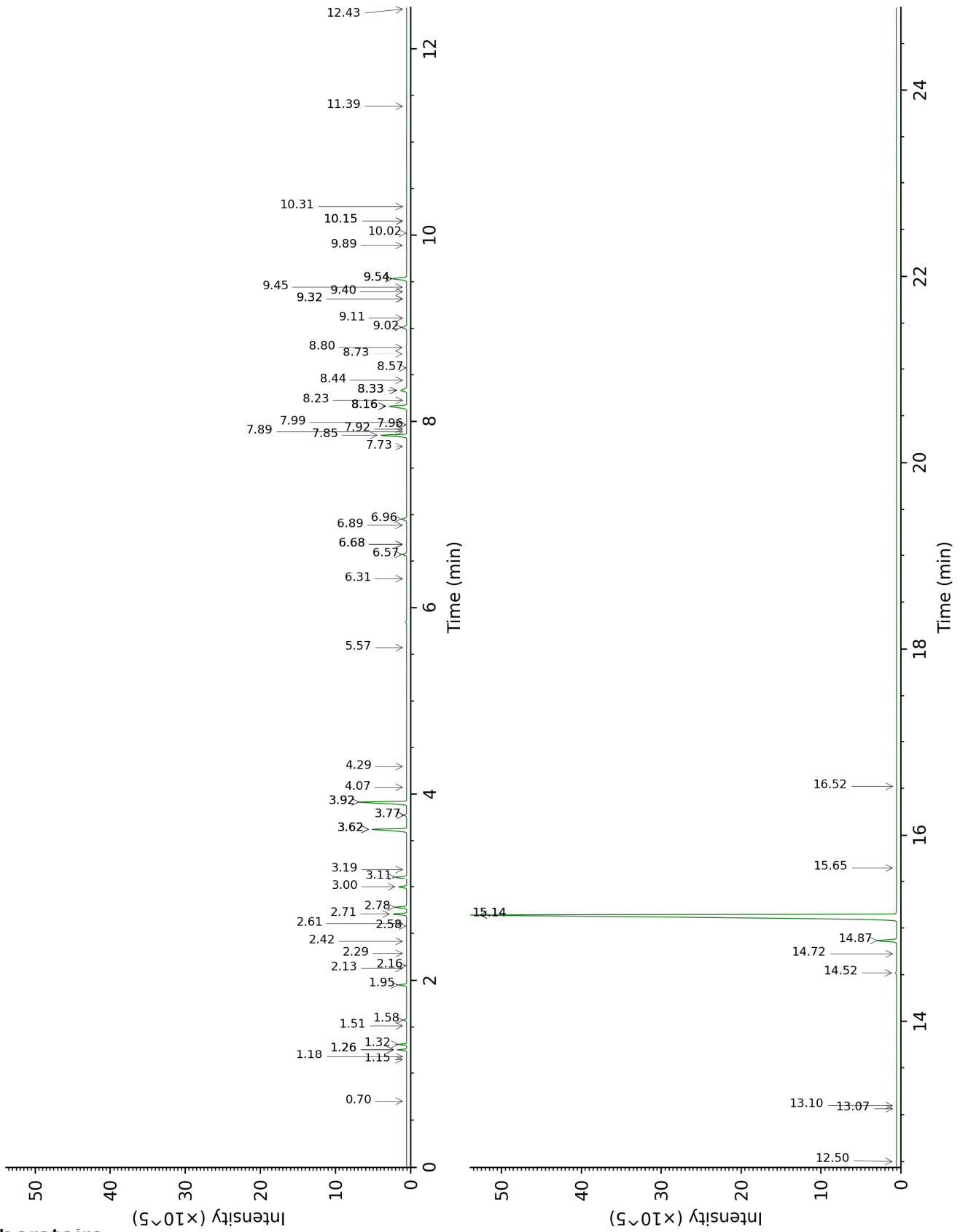
**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm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

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DB-WAX



FULL ANALYSIS DATA

| Identification                                                    | Column DB-5 |      |        | Column DB-WAX |      |        |
|-------------------------------------------------------------------|-------------|------|--------|---------------|------|--------|
|                                                                   | R.T         | R.I  | %      | R.T           | R.I  | %      |
| Isovaleral                                                        | 0.65        | 640  | tr     | 0.70          | 886  | tr     |
| Methyl 2-methylbutyrate                                           | 1.36        | 774  | tr     | 1.18          | 975  | tr     |
| (2E)-Hexenal                                                      | 2.12        | 849  | 0.01   | 3.19          | 1172 | 0.01   |
| (3Z)-Hexenol                                                      | 2.23        | 857  | 0.01   | 5.57          | 1349 | 0.01   |
| Hashishene                                                        | 2.98        | 916  | 0.01   | 1.26*         | 989  | 0.66   |
| Tricyclene                                                        | 3.02        | 918  | 0.02   | 1.15          | 969  | 0.02   |
| $\alpha$ -Thujene                                                 | 3.14        | 926  | 0.53   | 1.32          | 998  | 0.54   |
| $\alpha$ -Pinene                                                  | 3.21        | 931  | 0.64   | 1.26*         | 989  | [0.66] |
| Camphene                                                          | 3.40*       | 943  | 0.25   | 1.58          | 1024 | 0.23   |
| $\alpha$ -Fenchene                                                | 3.40*       | 943  | [0.25] | 1.51          | 1018 | 0.01   |
| Thuja-2,4(10)-diene                                               | 3.50        | 950  | 0.01   | 2.16          | 1085 | 0.01   |
| $\beta$ -Pinene                                                   | 3.83*       | 971  | 0.74   | 1.95          | 1064 | 0.72   |
| Sabinene                                                          | 3.83*       | 971  | [0.74] | 2.13          | 1082 | 0.01   |
| Unknown [m/z 93, 79 (73), 67 (49), 95 (42), 91 (41), 121 (38)...] | 3.95        | 979  | 0.03   | 2.29          | 1098 | 0.01   |
| Octen-3-ol                                                        | 4.02        | 984  | 0.45   | 6.57          | 1421 | 0.46   |
| Octan-3-one                                                       | 4.06        | 987  | 0.22   | 3.78*         | 1219 | 0.22   |
| Myrcene                                                           | 4.15        | 993  | 1.21   | 2.71          | 1133 | 1.21   |
| $\alpha$ -Phellandrene                                            | 4.26*       | 1000 | 0.11   | 2.58          | 1122 | 0.02   |
| Pseudolimonene                                                    | 4.26*       | 1000 | [0.11] | 2.61          | 1124 | 0.03   |
| <i>cis</i> -Dehydroxylinalool oxide                               | 4.32        | 1004 | 0.01   | 3.62*         | 1207 | 4.09   |
| $\Delta$ 3-Carene                                                 | 4.38        | 1007 | 0.02   | 2.42          | 1109 | 0.01   |
| $\alpha$ -Terpinene                                               | 4.50        | 1014 | 1.08   | 2.78          | 1139 | 1.08   |
| meta-Cymene                                                       | 4.58        | 1020 | 0.03   | 3.92*         | 1229 | 5.82   |
| para-Cymene                                                       | 4.63        | 1023 | 5.78   | 3.92*         | 1229 | [5.82] |
| Limonene                                                          | 4.70*       | 1027 | 1.91   | 3.00          | 1156 | 0.76   |
| 1,8-Cineole                                                       | 4.70*       | 1027 | [1.91] | 3.11          | 1166 | 1.15   |
| ortho-Cymene                                                      | 4.83        | 1035 | 0.02   | 4.30          | 1258 | 0.01   |
| (Z)- $\beta$ -Ocimene                                             | 4.90        | 1040 | 0.01   | 3.62*         | 1207 | [4.09] |
| (E)- $\beta$ -Ocimene                                             | 5.06        | 1050 | 0.02   | 3.78*         | 1219 | [0.22] |
| $\gamma$ -Terpinene                                               | 5.19        | 1058 | 4.06   | 3.62*         | 1207 | [4.09] |
| <i>cis</i> -Sabinene hydrate                                      | 5.31        | 1065 | 0.03   | 6.68*         | 1429 | 0.03   |
| <i>cis</i> -Linalool oxide (fur.)                                 | 5.39        | 1070 | 0.02   | 6.31          | 1402 | 0.01   |
| Octanol                                                           | 5.49        | 1076 | 0.01   | 7.96          | 1526 | 0.01   |
| <i>trans</i> -Linalool oxide (fur.)                               | 5.64*       | 1086 | 0.04   | 6.68*         | 1429 | [0.03] |
| Terpinolene                                                       | 5.64*       | 1086 | [0.04] | 4.07          | 1241 | 0.02   |
| <i>trans</i> -Sabinene hydrate                                    | 5.80        | 1096 | 0.02   | 7.73          | 1508 | 0.01   |
| Linalool                                                          | 5.92        | 1103 | 2.83   | 7.85          | 1517 | 2.84   |



|                                                        |       |      |       |        |      |        |
|--------------------------------------------------------|-------|------|-------|--------|------|--------|
| Hotrienol                                              | 5.95  | 1105 | 0.01  | 8.57   | 1573 | 0.01   |
| <i>cis</i> -para-Menth-2-en-1-ol                       | 6.17  | 1119 | 0.01  | 7.92   | 1522 | 0.01   |
| Camphor                                                | 6.44  | 1136 | 0.63  | 6.96   | 1450 | 0.60   |
| Isoborneol                                             | 6.70  | 1153 | 0.01  | 9.11   | 1616 | 0.01   |
| Unknown [m/z 123, 81 (46), 43 (45), 95 (34), 166 (30)] | 6.76  | 1157 | 0.01  | 8.73   | 1585 | 0.01   |
| Borneol                                                | 6.86  | 1163 | 1.12  | 9.54*  | 1650 | 1.88   |
| <i>trans</i> -2-Caren-4-ol?                            | 6.92  | 1167 | 0.01  |        |      |        |
| Terpinen-4-ol                                          | 7.03  | 1174 | 0.65  | 8.33*  | 1554 | 0.88   |
| $\alpha$ -Terpineol                                    | 7.26  | 1188 | 0.39  | 9.54*  | 1650 | [1.88] |
| Myrtenal                                               | 7.30  | 1191 | 0.03  | 8.44   | 1563 | 0.01   |
| <i>cis</i> -Dihydrocarvone                             | 7.35  | 1194 | 0.40  | 8.23   | 1546 | 0.02   |
| <i>trans</i> -Piperitol                                | 7.58  | 1209 | 0.01  | 10.15* | 1700 | 0.01   |
| Thymol methyl ether analog I (isothymol methyl ether?) | 7.95  | 1234 | 0.01  | 8.16*  | 1541 | 2.38   |
| Carvacrol methyl ether                                 | 8.08  | 1242 | 0.23  | 8.33*  | 1554 | [0.88] |
| Geraniol                                               | 8.29  | 1257 | 0.01  | 11.39  | 1805 | 0.02   |
| Linalyl acetate                                        | 8.35  | 1260 | 0.01  | 7.89   | 1520 | 0.01   |
| Bornyl acetate                                         | 8.73  | 1286 | 0.01  | 7.99   | 1528 | 0.01   |
| Thymol analogue I (isothymol?)                         | 8.91  | 1298 | 0.01  | 14.72  | 2116 | 0.01   |
| Thymol                                                 | 9.00  | 1304 | 2.06  | 14.87  | 2130 | 2.05   |
| Carvacrol                                              | 9.24  | 1321 | 70.27 | 15.14* | 2158 | 70.39  |
| 2-Methyl-6-propylphenol?                               | 9.31  | 1326 | 0.05  |        |      |        |
| $\alpha$ -Terpinyl acetate                             | 9.66  | 1350 | 0.04  | 9.44   | 1643 | 0.04   |
| Eugenol                                                | 9.75  | 1357 | 0.13  | 14.52  | 2096 | 0.14   |
| $\alpha$ -Copaene                                      | 9.96  | 1372 | 0.03  | 6.89   | 1445 | 0.02   |
| Geranyl acetate                                        | 10.15 | 1385 | 0.01  | 10.31  | 1713 | 0.01   |
| $\beta$ -Elemene                                       | 10.21 | 1389 | 0.01  | 8.16*  | 1541 | [2.38] |
| Methyleugenol                                          | 10.42 | 1404 | 0.02  | 13.07  | 1957 | 0.01   |
| $\beta$ -Caryophyllene                                 | 10.55 | 1414 | 2.38  | 8.16*  | 1541 | [2.38] |
| $\beta$ -Copaene                                       | 10.66 | 1422 | 0.01  | 8.16*  | 1541 | [2.38] |
| 9-epi-Isocaryophyllene                                 | 10.96 | 1444 | 0.06  | 8.80   | 1591 | 0.07   |
| $\alpha$ -Humulene                                     | 11.00 | 1447 | 0.58  | 9.02   | 1608 | 0.59   |
| ( <i>E</i> )- $\beta$ -Farnesene                       | 11.14 | 1457 | 0.01  | 9.32*  | 1632 | 0.02   |
| allo-Aromadendren-9-ene                                | 11.44 | 1479 | 0.01  | 9.32*  | 1632 | [0.02] |
| Viridiflorene                                          | 11.56 | 1489 | 0.01  | 9.40   | 1639 | 0.01   |
| (3 <i>Z</i> ,6 <i>E</i> )- $\alpha$ -Farnesene         | 11.66 | 1496 | 0.01  | 10.02  | 1689 | 0.01   |
| $\beta$ -Bisabolene                                    | 11.80 | 1506 | 0.04  | 9.89   | 1679 | 0.04   |
| $\delta$ -Cadinene                                     | 11.96 | 1519 | 0.01  | 10.15* | 1700 | [0.01] |

|                                                                       |        |               |        |        |               |         |
|-----------------------------------------------------------------------|--------|---------------|--------|--------|---------------|---------|
| Caryophyllene oxide isomer                                            | 12.65* | 1573          | 0.10   | 12.43  | 1898          | 0.02    |
| Caryophyllene oxide                                                   | 12.65* | 1573          | [0.10] | 12.50  | 1905          | 0.08    |
| Humulene epoxide II                                                   | 12.98  | 1599          | 0.02   | 13.10  | 1960          | 0.02    |
| (3Z)-Caryophylla-3,8(13)-dien-5β-ol                                   | 13.79  | 1666          | 0.01   | 16.52  | 2302          | 0.01    |
| Unknown [m/z 81, 150 (90), 136 (88), 135 (74), 93 (54), 121 (41)...]  | 15.98  | 1856          | 0.02   |        |               |         |
| Unknown [m/z 81, 150 (83), 136 (81), 135 (67), 93 (48), 121 (36)...]  | 16.39  | 1893          | 0.02   |        |               |         |
| Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...]  | 16.69  | 1920          | 0.01   | 15.65  | 2210          | 0.01    |
| meta-Camphorene                                                       | 16.98  | 1948          | 0.01   | 15.14* | 2158          | [70.39] |
| Unknown [m/z 151, 135 (46), 109 (41), 43 (26), 150 (24), 107 (23)...] | 17.18  | 1968          | 0.01   |        |               |         |
| Unknown [m/z 135, 150 (66), 43 (38), 109 (27), 93 (25), 137 (20)...]  | 17.72  | 2019          | 0.02   |        |               |         |
| <b>Total identified</b>                                               |        | <b>99.54%</b> |        |        | <b>99.39%</b> |         |
| <b>Total reported</b>                                                 |        | <b>99.65%</b> |        |        | <b>99.43%</b> |         |

\*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

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