

Date : June 18, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20B12-PTH13

Customer identification : Vetiver - Haiti - V30107810R

Type : Essential oil

Source : *Vetiveria zizanioides* ct. Haiti

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 : February 17, 2020

Checked and approved by :

Sylvain Mercier, M. Sc., chimiste 2014-005

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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

This report is an update of the version first issued on February 21, 2020 to indicatively present comparison to a standard.

PHYSICOCHEMICAL DATA

Physical aspect: Orange viscous liquid

Refractive index: 1.5229 ± 0.0003 (20 °C)

ISO 4716:2013 - ESSENTIAL OIL OF VETIVER - HAITI

Compound	Min. %	Max. %	Observed %	Complies?
(E)-Isovalencenol	10	16	9	No
α-Vetivone	2	4	3	Yes
Khusimol	9	15	10	Yes
β-Vetivone	2	4	3	Yes
β-Vetivenene	0.7	3.0	3.4	No
Refractive index	1.5160	1.5270	1.5229	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	%	Classe
α-Pinene	0.02	Monoterpene
4-Vinylguaiaacol	0.02	Simple phenolic
α-Cubebene	0.02	Sesquiterpene
Unknown	0.01	Norsesquiterpene
Cyclosativene I	0.06	Sesquiterpene
12-Norisoziza-5-ene	0.07	Norsesquiterpene
α-Ylangene	0.12	Sesquiterpene
α-Copaene	0.02	Sesquiterpene
2-Norzizaene?	0.04	Norsesquiterpene
6-epi-Nigritene	0.07	Norsesquiterpene
Nigritene	0.06	Norsesquiterpene
β-Elemene	0.07	Sesquiterpene
Cyperene	0.03	Sesquiterpene
Acora-3,7(14)-diene	0.15	Sesquiterpene
β-Funebrene	0.08	Sesquiterpene
Aristolene	0.01	Sesquiterpene
Cascarilladiene	0.02	Sesquiterpene
β-Caryophyllene	0.03	Sesquiterpene
β-Copaene	0.02	Sesquiterpene
6,9-Guaiadiene	0.15	Sesquiterpene
Prezizaene	0.38	Sesquiterpene
Khusimene	0.48	Sesquiterpene
Unknown	0.39	Sesquiterpene
Unknown	0.17	Sesquiterpene
Unknown	0.28	Sesquiterpene
Unknown	0.36	Sesquiterpene
α-Amorphene	1.53	Sesquiterpene
α-Vetispirene	0.59	Sesquiterpene
β-Vetispirene	1.39	Sesquiterpene
cis-Eudesma-6,11-diene	0.62	Sesquiterpene
γ-Amorphene	0.13	Sesquiterpene
δ-Selinene	0.48	Sesquiterpene
Bicyclosesquiphellandrene?	0.58	Sesquiterpene
Eudesma-2,4(15),11-triene	0.35	Sesquiterpene
Unknown	0.15	Sesquiterpene
δ-Amorphene	1.01	Sesquiterpene
γ-Cadinene	0.13	Sesquiterpene
Nootkatene	0.24	Sesquiterpene
Spirovetiva-1(10),7(11)-diene	0.98	Sesquiterpene
δ-Cadinene	0.46	Sesquiterpene
γ-Vetivenene	0.17	Sesquiterpene
11,12,13-trinor-trans-Eudesm-5-en-7-one	0.19	Terpenic ketone
β-Vetivenene	3.39	Sesquiterpene
α-Elemol	0.53	Sesquiterpenic alcohol
cis-Eudesm-6-en-11-ol	1.30	Sesquiterpenic alcohol
Unknown	0.41	Oxygenated sesquiterpene
Unknown	0.83	Oxygenated sesquiterpene

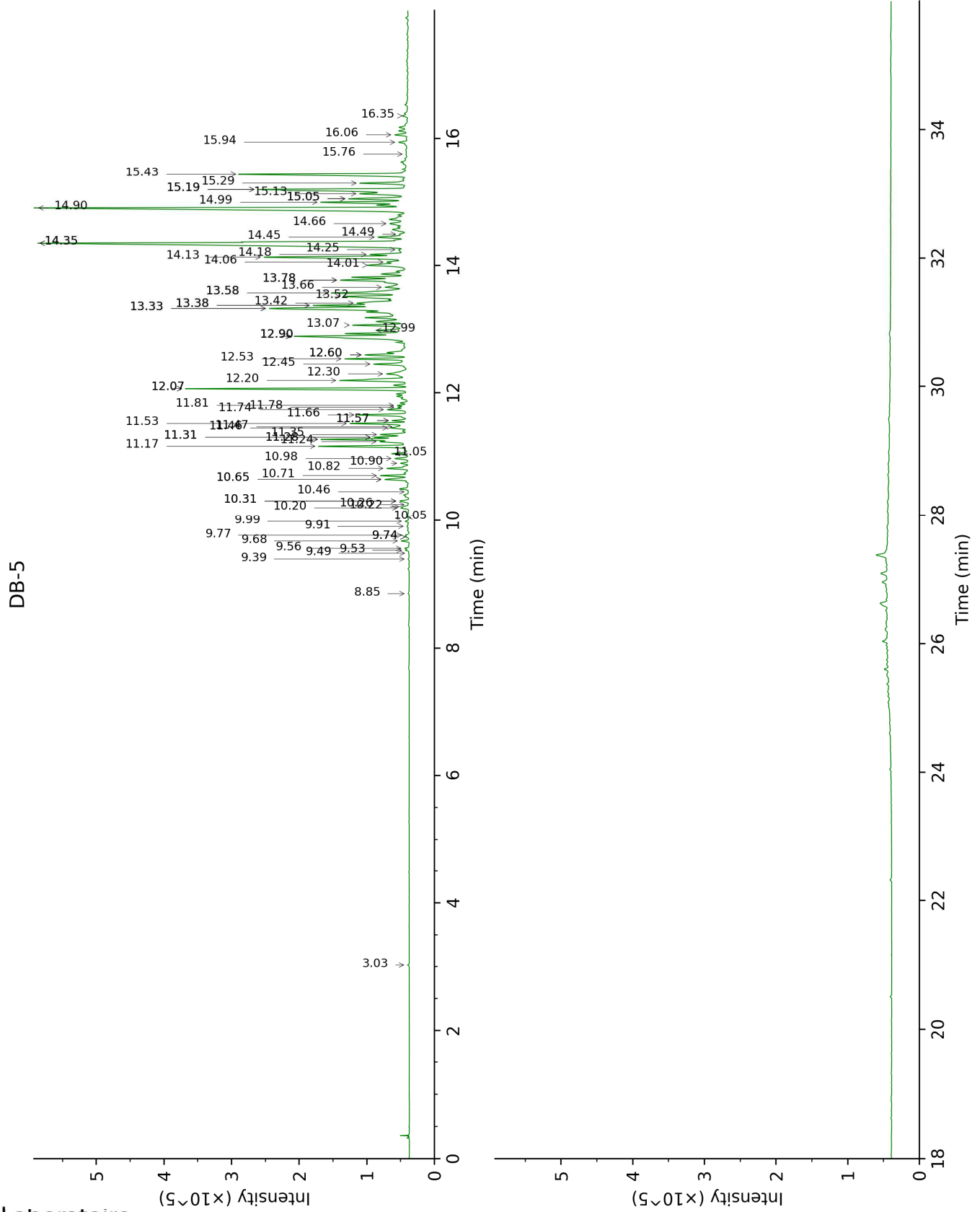
Unknown	1.12	Sesquiterpene
Unknown	0.24	Oxygenated sesquiterpene
Khusimone	0.70	Norsesquiterpenic ketone
Unknown	0.48	Oxygenated sesquiterpene
Unknown	0.56	Sesquiterpene
Selin-6-en-4 α -ol isomer	1.66	Sesquiterpenic alcohol
Unknown	0.74	Oxygenated sesquiterpene
Unknown	1.23	Unknown
Unknown	1.72	Sesquiterpenic alcohol
Cyclocopacamphan-12-ol, epimer A	1.42	Sesquiterpenic alcohol
Cyclocopacamphan-12-ol, epimer B	1.60	Sesquiterpenic alcohol
Unknown	0.56	Oxygenated sesquiterpene
Unknown	1.45	Oxygenated sesquiterpene
Zizanol	1.73	Sesquiterpenic alcohol
Khusiol	1.79	Sesquiterpenic alcohol
epi-Zizanone	0.67	Sesquiterpenic ketone
Zizanal	0.72	Sesquiterpenic aldehyde
Unknown	1.17	Oxygenated sesquiterpene
α -Costal?	0.38	Sesquiterpenic aldehyde
Unknown	1.25	Oxygenated sesquiterpene
Unknown	0.45	Oxygenated sesquiterpene
Vetiselinenol	3.32	Sesquiterpenic alcohol
α -Vetivol?	0.76	Sesquiterpenic alcohol
Unknown	0.20	Oxygenated sesquiterpene
Khusimol	9.90	Sesquiterpenic alcohol
Unknown	2.81	Oxygenated sesquiterpene
10-epi-Acora-3,11-dien-15-al?	0.76	Sesquiterpenic aldehyde
Unknown	0.19	Oxygenated sesquiterpene
β -Costol	0.64	Sesquiterpenic alcohol
(<i>E</i>)-Isovalencenol	9.40	Sesquiterpenic alcohol
Unknown	1.65	Oxygenated sesquiterpene
Unknown	1.15	Oxygenated sesquiterpene
Nootkatone	0.15	Sesquiterpenic ketone
(<i>Z</i>)-Isovalencenal	0.73	Sesquiterpenic aldehyde
β -Vetivone	2.68	Sesquiterpenic ketone
Zizanoic acid	1.50	Sesquiterpenic acid
(<i>E</i>)-Isovalencenal	1.00	Sesquiterpenic aldehyde
α -Vetivone	3.44	Sesquiterpenic ketone
(<i>E</i>)-Isovalencenyl acetate?	0.09	Sesquiterpenic ester
Isovalencenal isomer II?	0.21	Sesquiterpenic aldehyde
Isovalencenal isomer I?	0.30	Sesquiterpenic aldehyde
β -Cyclodihydrocostunolide?	0.14	Sesquiterpenic lactone
Consolidated total	81.25%	

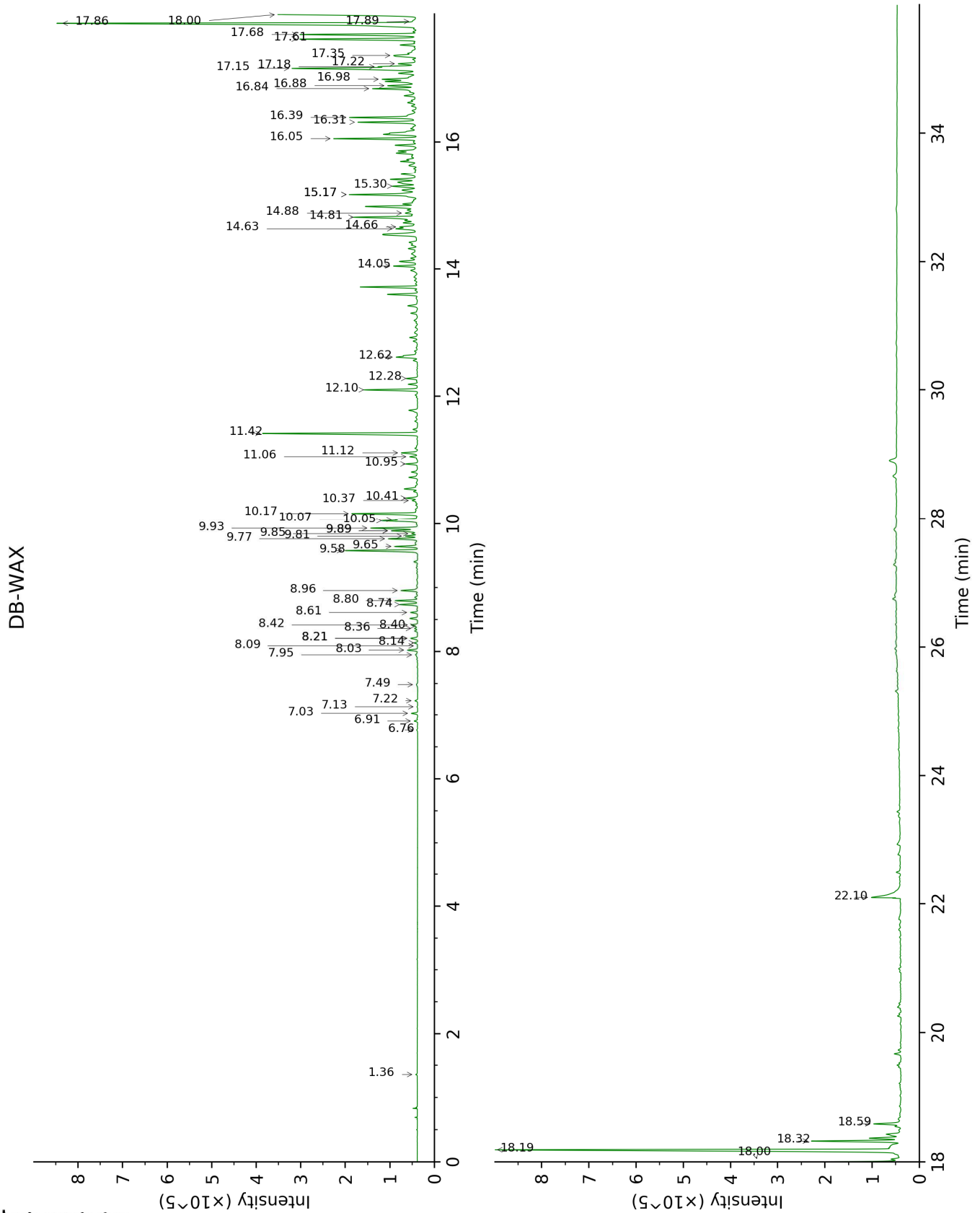
Note: no correction factor was applied

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	%
α-Pinene	3.03	930	0.02	1.36	990	0.02
4-Vinylguaiacol	8.85	1309	0.02	15.17*	2133	1.74
α-Cubebene	9.39	1347	0.02	6.76	1418	0.03
Unknown [m/z 145, 188 (95), 117 (91), 173 (80), 91 (65), 131 (64)]	9.49	1354	0.01			
Cyclosativene I	9.53	1357	0.06	6.90	1428	0.07
12-Norisoziza-5-ene	9.56	1359	0.07	7.22	1452	0.06
α-Ylangene	9.68	1368	0.12	7.02	1437	0.12
α-Copaene	9.74*	1372	0.06	7.13	1445	0.02
2-Norzizaene?	9.74*	1372	[0.06]			
6-epi-Nigritene	9.77	1374	0.07	7.95	1506	0.05
Nigritene	9.91	1384	0.06	8.14	1521	0.08
β-Elemene	9.99	1389	0.07	8.42	1542	0.14
Cyperene	10.05	1394	0.03	7.48	1472	0.05
Acora-3,7(14)-diene	10.20	1405	0.15	8.21*	1526	0.17
β-Funebrene	10.22	1406	0.08	8.09	1517	0.01
Aristolene	10.26	1409	0.01	8.02	1512	0.22
Cascarilladiene	10.31*	1413	0.21	8.21*	1526	[0.17]
β-Caryophyllene	10.31*	1413	[0.21]	8.40	1541	0.03
β-Copaene	10.46	1424	0.02	8.36	1538	0.07
6,9-Guaiadiene	10.65*	1438	0.53	8.61	1558	0.15
Prezizaene	10.65*	1438	[0.53]	8.74	1567	0.38
Khusimene	10.71	1442	0.48	8.80	1572	0.47
Unknown [m/z 105, 161 (78), 93 (70), 133 (67), 91 (66), 204 (63), 119 (41)]	10.82	1451	0.39	8.96	1584	0.37
Unknown [m/z 119, 190 (99), 175 (95), 105 (71), 91 (59), 120 (57)... 204 (2)]	10.90	1457	0.17			
Unknown [m/z 119, 120 (31), 83 (23), 105 (22), 91 (21), 81 (18)... 202 (9)]	10.98	1462	0.28	9.81	1652	0.26
Unknown [m/z 145, 202 (85), 159 (64), 187 (39), 131 (35), 117 (34)]	11.05	1468	0.36	9.89*†	1659	1.59
α-Amorphene	11.17	1477	1.53	9.58	1634	1.53
α-Vetispirene	11.24	1482	0.59	10.07†	1674	[1.18]
β-Vetispirene	11.28*†	1485	2.04	10.17	1682	1.39
cis-Eudesma-6,11-diene	11.28*†	1485	[2.04]	9.77	1649	0.62
γ-Amorphene	11.31*†	1487	[2.04]	9.84	1655	0.13
δ-Selinene	11.31*†	1487	[2.04]	9.65	1639	0.48
Bicyclosesquiphellandrene?	11.35	1490	0.58	9.89*†	1659	[1.59]
Eudesma-2,4(15),11-triene	11.46	1498	0.35	11.12	1761	0.39
Unknown [m/z 131, 145 (59), 202 (55), 187 (31), 91 (26), 159 (24)]	11.47	1499	0.15			
δ-Amorphene	11.52	1503	1.01	9.93†	1662	[1.59]

γ-Cadinene	11.57*	1507	0.31	10.37	1698	0.13
Nootkatene	11.57*	1507	[0.31]	10.95	1746	0.24
Spirovetiva-1(10),7(11)-diene	11.66	1514	0.98	10.05†	1672	1.18
δ-Cadinene	11.74	1520	0.46	10.41	1701	0.26
γ-Vetivenene	11.78	1523	0.17	11.06	1756	0.17
11,12,13-trinor-trans-Eudesm-5-en-7-one	11.81	1525	0.19			
β-Vetivenene	12.07*	1546	3.78	11.42	1787	3.39
α-Elemol	12.07*	1546	[3.78]	14.05	2025	0.53
cis-Eudesm-6-en-11-ol	12.20	1556	1.30			
Unknown [m/z 81, 200 (55), 143 (36), 93 (33), 91 (32), 185 (31), 129 (27), 128 (21)...]	12.30	1564	0.41			
Unknown [m/z 59, 43 (56), 205 (47), 91 (41), 220 (32), 105 (30), 147 (21)]	12.45	1576	0.83			
Unknown [m/z 202, 187 (63), 145 (43), 159 (34), 131 (29), 91 (22), 117 (20)]	12.53	1582	1.12	12.10	1846	1.11
Unknown [m/z 161, 119 (78), 105 (75), 120 (72), 43 (64)... 218 (4)]	12.60*	1587	0.94	12.28	1862	0.24
Khusimone	12.60*	1587	[0.94]			
Unknown [m/z 179, 161 (66), 119 (44), 95 (38), 105 (35)... 204 (24), 222 (1)]	12.90*	1611	3.39	14.66	2083	0.48
Unknown [m/z 187, 202 (86), 145 (25), 131 (19), 105 (16), 188 (15)]	12.90*	1611	[3.39]	12.62	1892	0.56
Selin-6-en-4α-ol isomer	12.90*	1611	[3.39]	14.81	2098	1.66
Unknown [m/z 59, 149 (94), 43 (82), 205 (65)... 220 (6)]	12.99	1619	0.74			
Unknown [m/z 145, 59 (97), 161 (87), 218 (76), 43 (76), 179 (63)...]	13.07	1626	1.23			
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.33*	1647	3.92	15.17*	2133	[1.74]
Cyclocopacamphan-12-ol, epimer A	13.33*	1647	[3.92]	16.31	2249	1.42
Cyclocopacamphan-12-ol, epimer B	13.38*	1651	1.76	16.38	2257	1.60
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.38*	1651	[1.76]	14.63	2080	0.56
Unknown [m/z 84, 119 (77), 41 (72), 81 (68), 95 (68), 93 (68), 109 (63)... 222 (17)]	13.42	1654	1.45			

Zizanol	13.52	1663	1.73	16.84	2304	1.13
Khusiol	13.58*	1667	2.21	16.05	2223	1.79
epi-Zizanone	13.58*	1667	[2.21]	15.30	2146	0.67
Zizanal	13.66	1675	0.72	17.22	2346	0.49
Unknown [m/z 189, 43 (91), 81 (89), 105 (81), 91 (74), 93 (74), 133 (67), 41 (67)... 222 (37)]	13.78*	1684	1.55			
α-Costal?	13.78*	1684	[1.55]	14.88	2104	0.38
Unknown [m/z 189, 159 (82), 133 (44), 91 (29), 105 (29), 205 (25)... 220 (13)]	14.01	1703	1.25	16.98	2320	0.84
Unknown [m/z 204, 189 (99), 43 (83), 161 (75), 105 (55), 91 (44), 119 (33)... 220 (13)]	14.06	1707	0.45			
Vetiselinenol	14.14	1714	3.32	17.15	2338	3.40
α-Vetivol?	14.18	1717	0.76	17.61	2387	2.70
Unknown [m/z 136, 121 (98), 137 (90), 119 (68), 107 (55), 135 (55)... 202 (30), 220 (27)]	14.25	1724	0.20			
Khusimol	14.35*†	1733	12.71	17.86	2414	9.90
Unknown [m/z 189, 187 (29), 159 (23), 43 (20), 133 (16)...]	14.35*†	1733	[12.71]			
10-epi-Acora-3,11-dien-15-al?	14.45	1741	0.76			
Unknown [m/z 91, 105 (89), 79 (84), 93 (77), 107 (67), 189 (64), 145 (62), 119 (61)... 220 (16)...]	14.49	1745	0.19			
β-Costol	14.66	1759	0.64	18.59	2496	0.66
(E)-Isovalencenol	14.90	1780	9.40	18.19	2451	9.54
Unknown [m/z 120, 121 (93), 93 (85), 105 (74), 119 (68), 91 (58), 123 (49)... 220 (8)]	14.99	1788	1.65	18.32	2466	1.80
Unknown [m/z 202, 187 (91), 93 (70), 91 (69), 105 (67)...]	15.05*	1793	1.29			
Nootkatone	15.05*	1793	[1.29]	17.89	2418	0.15
(Z)-Isovalencenal	15.13†	1800	4.85	17.18	2341	0.73
β-Vetivone	15.19*†	1806	[4.85]	17.68	2395	2.68
Zizanoic acid	15.19*†	1806	[4.85]	22.10	2923	1.50
(E)-Isovalencenal	15.29	1814	1.00	17.35	2360	0.83
α-Vetivone	15.43	1827	3.44	18.00	2430	3.51
(E)-Isovalencenyl acetate?	15.76	1856	0.09	16.88	2309	0.77
Isovalencenal isomer II?	15.94	1873	0.21			
Isovalencenal isomer I?	16.06	1884	0.30			
β-Cyclodihydrocostunolide?	16.35	1911	0.14			

Total identified	70.51%	61.42%
Total reported	81.40%	67.62%

*: 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