

Date : March 16, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP31

Customer identification : Vetiver - Indonesia - 51284-13

Type : Essential oil

Source : *Vetiveria zizanioides* ct. Indonesia

Customer : Fern & Petal

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

Analysis date : March 16, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: ge viscous liquid

Refractive index: 1.5246 ± 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
Terpinen-4-ol	0.01	Monoterpenic alcohol
Coumaran	0.06	Simple phenolic
Carvone	0.01	Monoterpenic ketone
4-Ethylguaiaicol	0.03	Norphenylpropanoid
4-Vinylguaiaicol	0.08	Simple phenolic
Unknown	0.15	Sesquiterpene
2-Norprezizene	0.13	Sesquiterpene
Unknown	0.23	Unknown
12-Norisoziza-5-ene	1.74	Norsesquiterpene
Unknown	0.60	Norsesquiterpene
α -Ylangene	0.11	Sesquiterpene
6-epi-Nigritene	2.02	Norsesquiterpene
Nigritene	3.18	Norsesquiterpene
Unknown	0.12	Unknown
Acora-3,7(14)-diene	0.34	Sesquiterpene
α -Cedrene	0.18	Sesquiterpene
β -Copaene	0.39	Sesquiterpene
Prezizaene	0.94	Sesquiterpene
Unknown	1.18	Norsesquiterpene
Khusimene	1.28	Sesquiterpene
Selina-4(15),7-diene	0.41	Sesquiterpene
Unknown	0.74	Sesquiterpene
Unknown	0.50	Sesquiterpene
Unknown	0.50	Sesquiterpene
α -Amorphene	1.88	Sesquiterpene
β -Vetispirene	1.23	Sesquiterpene
α -Vetispirene	1.57	Sesquiterpene
γ -Amorphene	1.32	Sesquiterpene
δ -Selinene	1.12	Sesquiterpene
epi-Cubebol	0.73	Sesquiterpenic alcohol
Unknown	0.75	Sesquiterpene
δ -Amorphene	0.69	Sesquiterpene
Nootkatene	0.57	Sesquiterpene
Spirovetiva-1(10),7(11)-diene	0.96	Sesquiterpene
Unknown	0.43	Sesquiterpene
δ -Cadinene	0.29	Sesquiterpene
Zonarene	0.34	Sesquiterpene
γ -Vetivenene	2.67	Sesquiterpene
Selina-4(15),7(11)-diene	0.45	Sesquiterpene
Unknown	0.32	Sesquiterpene
β -Vetivenene	2.68	Sesquiterpene
Eremophila-1(10),11-dien-9 β -ol	1.34	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.33	Sesquiterpene
Unknown	0.20	Oxygenated sesquiterpene
Gynuradienol?	0.32	Sesquiterpenic alcohol

Unknown	0.88	Sesquiterpene
Unknown	0.16	Oxygenated sesquiterpene
Khusimone	0.45	Norsesquiterpenic ketone
Selin-6-en-4 α -ol isomer	0.48	Sesquiterpenic alcohol
Unknown	0.46	Sesquiterpene
Selin-6-en-4 α -ol	0.44	Sesquiterpenic alcohol
Unknown	0.81	Unknown
Unknown	0.89	Unknown
Unknown	1.52	Oxygenated sesquiterpene
Unknown	0.59	Sesquiterpenic alcohol
Cyclocopacamphan-12-ol, epimer A	0.88	Sesquiterpenic alcohol
Unknown	0.96	Oxygenated sesquiterpene
Cyclocopacamphan-12-ol, epimer B	1.76	Sesquiterpenic alcohol
Zizanol	1.46	Sesquiterpenic alcohol
Khusiol	1.23	Sesquiterpenic alcohol
Zizanone analog	0.92	Sesquiterpenic ketone
epi-Zizanone	0.50	Sesquiterpenic ketone
Zizanal	0.20	Sesquiterpenic aldehyde
Unknown	0.29	Oxygenated sesquiterpene
Unknown	3.19	Oxygenated sesquiterpene
Vetiselinenol	1.57	Sesquiterpenic alcohol
Khusimol	6.64	Sesquiterpenic alcohol
Unknown	0.14	Oxygenated sesquiterpene
(<i>E</i>)-Isovalencenol	1.42	Sesquiterpenic alcohol
Isozizanoic acid	3.29	Sesquiterpenic acid
Unknown	0.27	Oxygenated sesquiterpene
Nootkatone	0.10	Sesquiterpenic ketone
(<i>Z</i>)-Isovalencenal	0.26	Sesquiterpenic aldehyde
β -Vetivone	2.10	Sesquiterpenic ketone
Zizanoic acid	5.47	Sesquiterpenic acid
(<i>E</i>)-Isovalencenal	0.27	Sesquiterpenic aldehyde
α -Vetivone	3.20	Sesquiterpenic ketone
(<i>E</i>)-Isovalencenyl acetate?	0.08	Sesquiterpenic ester
Isovalencenal isomer II?	0.10	Sesquiterpenic aldehyde
Isovalencenal isomer I?	0.05	Sesquiterpenic aldehyde
β -Cyclodihydrocostunolide?	0.24	Sesquiterpenic lactone
Consolidated total	78.38%	

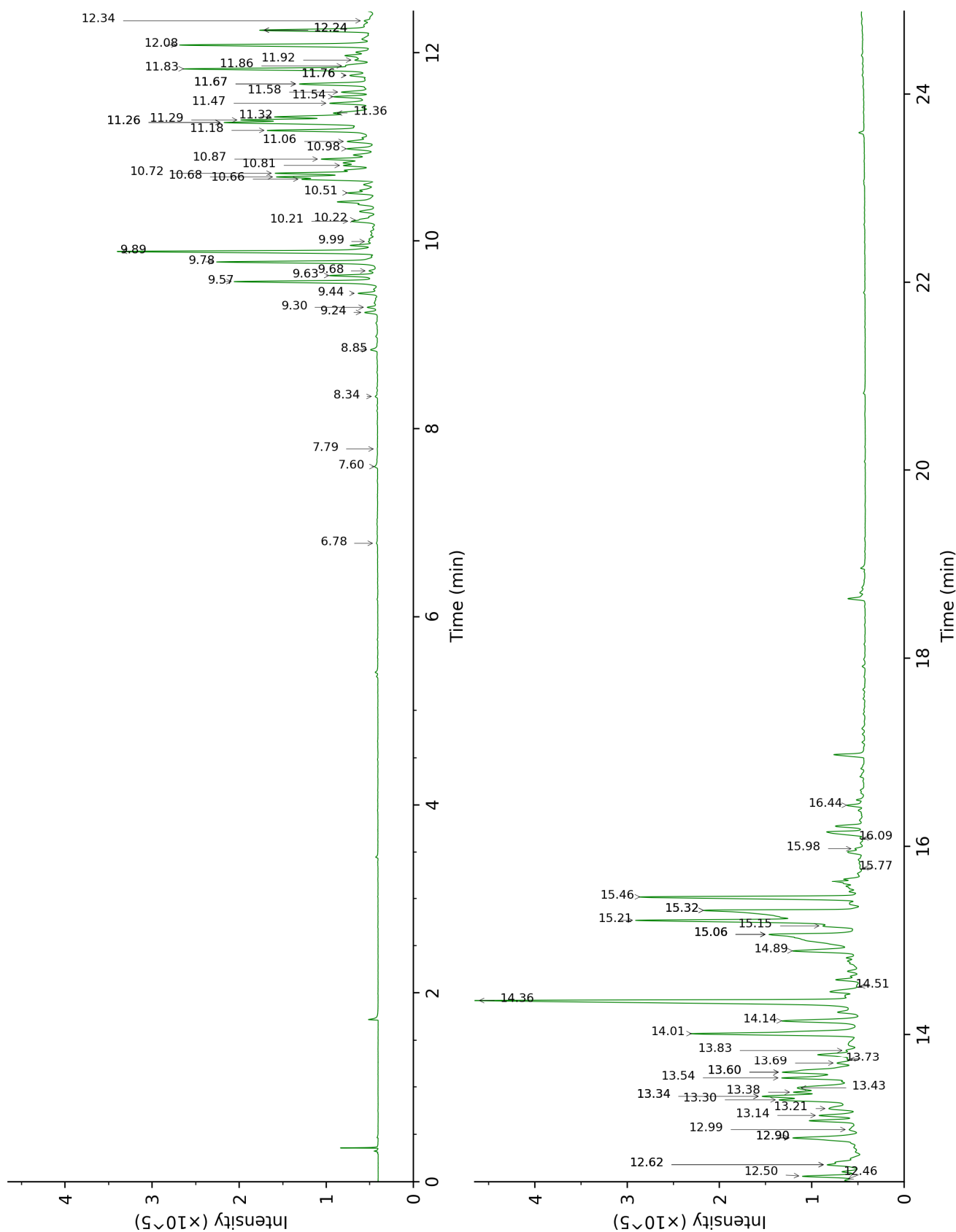
Note: no correction factor was applied

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.

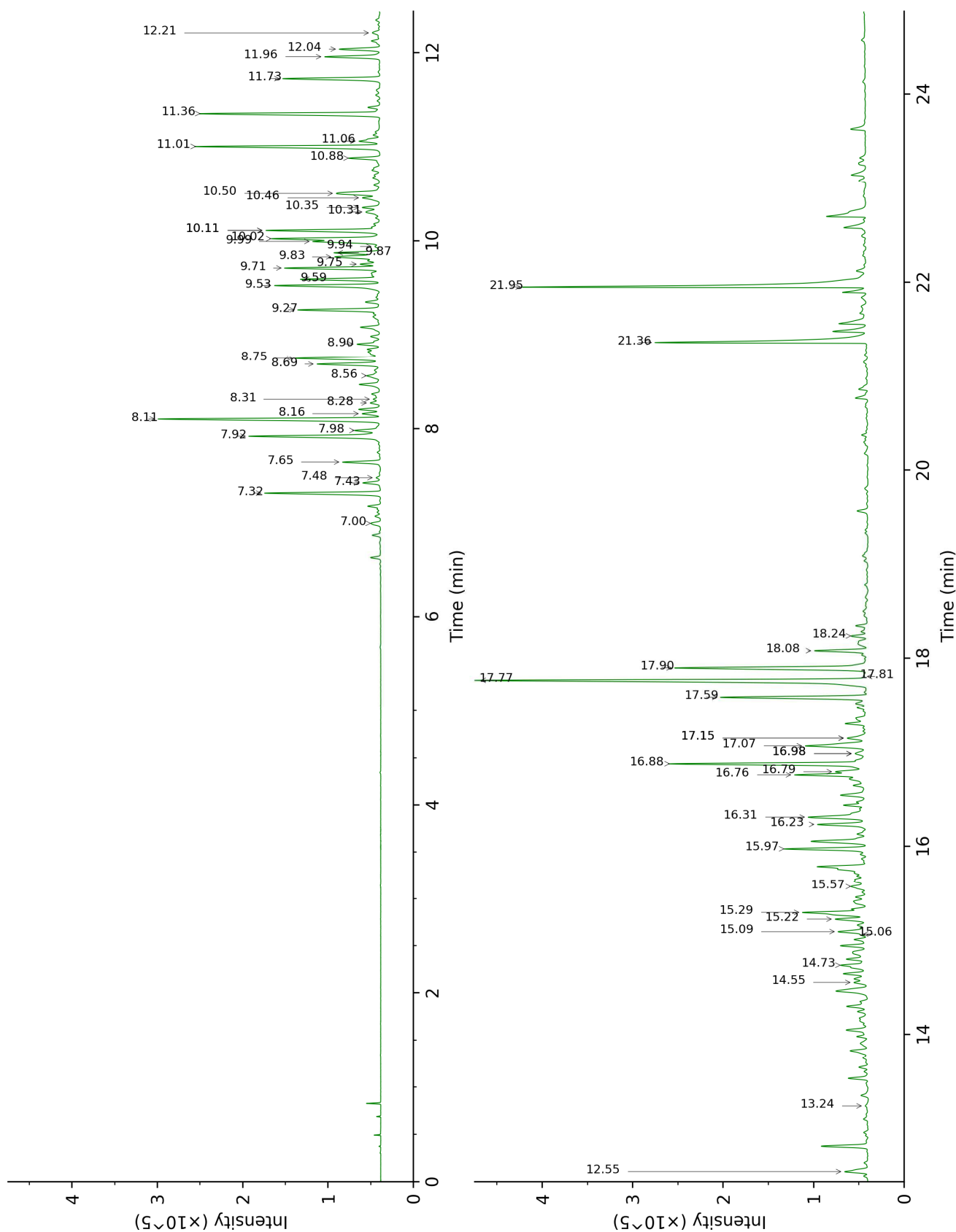
Unknowns: Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

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DB-5



DB-WAX



FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Terpinen-4-ol	6.78	1172	0.01	8.56	1559	0.34
Coumaran	7.60	1226	0.06	16.98*	2330	0.31
Carvone	7.79	1239	0.01	9.94	1669	0.09
4-Ethylguaiaicol	8.34	1277	0.03	13.24	1959	0.11
4-Vinylguaiaicol	8.85	1311	0.08	15.06	2133	0.10
Unknown [m/z 120, 91 (31), 92 (23), 121 (10), 105 (9), 119 (6)...202 (1)]	9.24	1335	0.15			
2-Norprezizene	9.30	1339	0.13	7.48	1476	0.07
Unknown [m/z 119, 91 (23), 120 (17), 118 (11), 92 (7), 105 (6)...]	9.44	1349	0.23	7.43	1472	0.28
12-Norisoziza-5-ene	9.57	1358	1.74	7.32	1464	1.56
Unknown [m/z 119, 147 (85), 161 (75), 91 (69), 105 (62), 134 (60), 190 (43)]	9.63	1362	0.60	7.65	1488	0.53
α-Ylangene	9.68	1366	0.11	7.00	1440	0.19
6-epi-Nigritene	9.78	1373	2.02	7.92	1509	2.10
Nigritene	9.89	1380	3.18	8.11	1523	3.25
Unknown [m/z 119, 91 (24), 120 (17), 118 (10), 92 (8), 41 (7), 105 (6)...]	9.99	1388	0.12	8.28	1536	0.17
Acora-3,7(14)-diene	10.21	1403	0.34	8.16	1528	0.28
α-Cedrene	10.22	1404	0.18	7.98	1514	0.43
β-Copaene	10.51	1425	0.39	8.32	1540	0.11
Prezizaene	10.66†	1437	2.06	8.69	1569	0.94
Unknown [m/z 175, 190 (73), 161 (65), 119 (40), 105 (35), 91 (28), 133 (23)]	10.68†	1438	[2.06]	9.27	1614	1.18
Khusimene	10.72	1441	1.28	8.75	1574	1.21
Selina-4(15),7-diene	10.81	1448	0.41	8.90	1585	0.34
Unknown [m/z 119, 190 (99), 175 (95), 105 (71), 91 (59), 120 (57)... 204 (2)]	10.87	1452	0.74			
Unknown [m/z 119, 120 (31), 83 (23), 105 (22), 91 (21), 81 (18)... 202 (9)]	10.98	1461	0.50	9.75	1654	0.27
Unknown [m/z 145, 202 (85), 159 (64), 187 (39), 131 (35), 117 (34)]	11.06	1466	0.50	9.83	1660	0.80
α-Amorphene	11.18	1475	1.88	9.53	1635	1.63
β-Vetispirene	11.26*†	1481	5.24	10.11*	1683	1.64
α-Vetispirene	11.26*†	1481	[5.24]	10.02	1676	1.57
γ-Amorphene	11.29†	1483	[5.24]	9.71	1650	1.32
δ-Selinene	11.32†	1486	[5.24]	9.59	1641	1.12
epi-Cubebol	11.36	1489	0.73	11.96	1841	0.81

Unknown [m/z 105, 91 (85), 93 (75), 119 (74), 107 (68), 145 (62), 202 (59)]	11.47	1496	0.75			
δ-Amorphene	11.54	1502	0.69	9.87	1664	0.66
Nootkatene	11.58	1505	0.57	10.88	1748	0.44
Spirovetiva-1(10),7(11)-diene	11.67*	1512	1.39	9.99	1673	0.96
Unknown [m/z 161, 204 (65), 105 (53), 119 (49), 91 (49), 147 (48), 189 (33)]	11.67*	1512	[1.39]	10.11*	1683	[1.64]
δ-Cadinene	11.76*	1519	0.46	10.35	1703	0.29
Zonarene	11.76*	1519	[0.46]	10.31	1699	0.34
γ-Vetivenene	11.83	1525	2.67	11.01	1758	2.64
Selina-4(15),7(11)-diene	11.86	1527	0.45	10.50	1715	0.94
Unknown [m/z 189, 204 (92), 161 (65), 133 (51), 105 (51), 91 (51), 119 (45)]	11.92	1532	0.32	10.46	1712	0.33
β-Vetivenene	12.08	1544	2.68	11.36	1788	2.63
Eremophila-1(10),11-dien-9β-ol	12.24*	1557	1.70	11.73	1820	1.34
Eudesma-5,7(11)-diene	12.24*	1557	[1.70]	11.06	1763	0.33
Unknown [m/z 81, 200 (55), 143 (36), 93 (33), 91 (32), 185 (31), 129 (27), 128 (21)...]	12.34	1565	0.20			
Gynuradienol?	12.46	1574	0.32			
Unknown [m/z 202, 187 (63), 145 (43), 159 (34), 131 (29), 91 (22), 117 (20)]	12.50	1577	0.88	12.04	1848	0.59
Unknown [m/z 161, 119 (78), 105 (75), 120 (72), 43 (64)... 218 (4)]	12.62*	1587	0.61	12.21	1863	0.16
Khusimone	12.62*	1587	[0.61]			
Selin-6-en-4α-ol isomer	12.90*	1609	1.72	14.74	2100	0.48
Unknown [m/z 187, 202 (86), 145 (25), 131 (19), 105 (16), 188 (15)]	12.90*	1609	[1.72]	12.55	1893	0.46
Selin-6-en-4α-ol	12.99	1616	0.44	15.57	2183	0.42
Unknown [m/z 145, 59 (97), 161 (87), 218 (76), 43 (76), 179 (63)...]	13.14	1629	0.81			
Unknown [m/z 43, 91 (87), 71 (83), 93 (77), 95 (75), 135 (74)...]	13.21	1635	0.89			
Unknown [m/z 121, 107 (69), 93 (64), 79 (60), 177 (59), 136 (58), 91 (57), 41 (56)... 220 (21)]	13.30	1642	1.52	15.29	2156	1.34
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.34*	1645	1.78	15.09	2135	0.59

Cyclocopacamphan-12-ol, epimer A	13.34*	1645	[1.78]	16.23	2251	0.88
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.38	1649	0.96	14.55	2082	0.25
Cyclocopacamphan-12-ol, epimer B	13.43	1652	1.76	16.31	2259	1.23
Zizanol	13.54	1661	1.46	16.76	2306	1.07
Khusiol	13.60*	1666	2.15	15.98	2224	1.23
Zizanone analog	13.60*	1666	[2.15]			
epi-Zizanone	13.69	1674	0.50	15.22	2148	0.56
Zizanal	13.74	1678	0.20	17.15*	2348	0.47
Unknown [m/z 189, 43 (91), 81 (89), 105 (81), 91 (74), 93 (74), 133 (67), 41 (67)... 222 (37)]	13.83	1686	0.29			
Unknown [m/z 189, 159 (82), 133 (44), 91 (29), 105 (29), 205 (25)... 220 (13)]	14.01	1700	3.19	16.88	2318	2.90
Vetiselinenol	14.14	1712	1.57	17.07	2339	1.37
Khusimol	14.36	1730	6.64	17.77	2415	6.16
Unknown [m/z 91, 105 (89), 79 (84), 93 (77), 107 (67), 189 (64), 145 (62), 119 (61)... 220 (16)...]	14.51	1744	0.14			
(E)-Isovalencenol	14.89	1776	1.42	18.08	2450	0.75
Isozizanoic acid	15.06*	1791	4.00	21.36	2844	3.29
Unknown [m/z 120, 121 (93), 93 (85), 105 (74), 119 (68), 91 (58), 123 (49)... 220 (8)]	15.06*	1791	[4.00]	18.24	2468	0.27
Nootkatone	15.06*	1791	[4.00]	17.81	2420	0.10
(Z)-Isovalencenal	15.15†	1799	9.11	16.98*	2330	[0.31]
β-Vetivone	15.21†	1804	[9.11]	17.59	2395	2.10
Zizanoic acid	15.32*†	1814	[9.11]	21.95	2920	5.47
(E)-Isovalencenal	15.32*†	1814	[9.11]	17.15*	2348	[0.47]
α-Vetivone	15.46	1827	3.20	17.90	2430	3.19
(E)-Isovalencenyl acetate?	15.77	1855	0.08	16.79	2309	0.50
Isovalencenal isomer II?	15.98	1874	0.10			
Isovalencenal isomer I?	16.09	1884	0.05			
β-Cyclodihydrocostunolide?	16.44	1916	0.24			
Total identified		67.84%			59.36%	
Total reported		80.63%			69.46%	

*: 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