

GC/MS BATCH NUMBER: V80102

ESSENTIAL OIL: VETIVER ORGANIC
BOTANICAL NAME: VETIVERIA ZIZANILIDES
ORIGIN: INDIA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF VETIVER ORGANIC OIL	%
KHUSIMOL	10.8
β-VETIVENENE	5.5
(E)-ISOVALENCENOL	5.2
β-VETIVONE	3.2
VETISELINENOL	2.6
ZIZANOL	2.5
α-AMORPHENE	2.1
ZIZANOIC ACID	2.0
β-VETISPIRENE	2.0
CIS-EUDESME-6-EN-11-OL	1.9
KHUSIOL	1.8
α-VETIVONE	1.7
γ-VETIVENENE	1.1
CYCLOCOPACAMPHAN-12-OL, EPIMER B	1.1
δ-AMORPHENE	1.1
CYCLOCOPACAMPHAN-12-OL, EPIMER A	1.0

Comments from Robert Tisserand: The odor quality is a very nice balance of earthy, smokey and woody-rooty. Constituents are in expected amounts.

Date : June 04, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18E31-PTH1-1-CC

Customer identification : Vetiver Organic - India - V8010281R

Type : Essential oil

Source : *Vetiveria zizanioides*

Customer : Plant Therapy

ANALYSIS

Method: PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Benoit Roger, Ph. D.

Analysis date : June 01, 2018

Checked and approved by :

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

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This report is digitally signed, it is only considered valid if the digital signature is intact.

PHYSICOCHEMICAL DATA

Physical aspect: Orange brownish viscous liquid

Refractive index: 1.5240 ± 0.0003 (20 °C)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isovaleral	tr	tr	Aliphatic aldehyde
2-Methylbutyral	tr	tr	Aliphatic aldehyde
Furfural	0.04	0.05	Aliphatic alcohol
Benzaldehyde	tr	tr	Simple phenolic
para-Cymene	tr	tr	Monoterpene
Limonene	tr	tr	Monoterpene
β-Phellandrene	tr	tr	Monoterpene
Coumaran	0.02	0.15	Simple phenolic
4-Vinylguaiaacol	0.01	0.23	Simple phenolic
α-Cubebene	0.02	0.01	Sesquiterpene
Unknown	0.17		Norsesquiterpene
α-Ylangene	0.12	0.12	Sesquiterpene
2-Norzizaene?	0.15		Norsesquiterpene
2-epi-α-Funebrene	0.09	0.07	Sesquiterpene
Nigritene	0.22*	0.29*	Norsesquiterpene
Unknown	[0.22]*		Norsesquiterpene
Cyperene	0.02	0.02	Sesquiterpene
α-Cedrene	0.16*	0.04	Sesquiterpene
Acora-3,7(14)-diene	[0.16]*	0.20	Sesquiterpene
β-Funebrene	0.14	[0.29]*	Sesquiterpene
Aristolene	0.22*	0.08	Sesquiterpene
β-Caryophyllene	[0.22]*	0.10	Sesquiterpene
β-Cedrene	[0.22]*	0.10	Sesquiterpene
β-Copaene	0.13	0.16	Sesquiterpene
6,9-Guaiadiene	0.88*	0.29	Sesquiterpene
Prezizaene	[0.88]*	0.50	Sesquiterpene
Khusimene	0.76	0.74	Sesquiterpene
Unknown	0.32		Sesquiterpene
Unknown	0.26		Sesquiterpene
Unknown	0.38		Sesquiterpene
Unknown	0.43		Sesquiterpene
α-Amorphene	2.11	1.96	Sesquiterpene
α-Vetispirene	4.15	0.59	Sesquiterpene
β-Vetispirene	[4.15]*	2.00	Sesquiterpene
cis-Eudesma-6,11-diene	[4.15]*	0.13	Sesquiterpene
γ-Amorphene	[4.15]*	0.19	Sesquiterpene
δ-Selinene	[4.15]*	0.52	Sesquiterpene
Bicyclosesquiphellandrene?	0.72	0.69	Sesquiterpene
Unknown	0.54*		Sesquiterpene
Eudesma-2,4(15),11-triene	[0.54]*	0.38	Sesquiterpene
δ-Amorphene	1.10	1.16	Sesquiterpene
γ-Cadinene	0.62*	0.16	Sesquiterpene
Nootkatene	[0.62]*	0.54	Sesquiterpene
Spirovetiva-1(10),7(11)-diene	0.92	1.00	Sesquiterpene
δ-Cadinene	0.11	0.16	Sesquiterpene
trans-Calamenene	0.39	0.10	Sesquiterpene
γ-Vetivenene	1.14	0.86	Sesquiterpene
(6S,10R)-Dimethylbicyclo[4.4.0]decan-	0.11		Terpenic ketone

1-en-3-one?			
α -Calacorene	0.72	1.01*	Sesquiterpene
β -Vetivenene	5.52	5.18	Sesquiterpene
α -Elemol	0.51	0.54	Sesquiterpenic alcohol
<i>cis</i> -Eudesm-6-en-11-ol	1.90		Sesquiterpenic alcohol
Unknown	0.74		Oxygenated sesquiterpene
Unknown	0.65		Oxygenated sesquiterpene
Unknown	0.90	[1.01]*	Sesquiterpene
Unknown	0.40	0.36	Oxygenated sesquiterpene
Khusimone?	0.78		Norsesquiterpenic ketone
Unknown	0.44	0.51	Oxygenated sesquiterpene
Unknown	3.37*	0.56	Sesquiterpene
Selin-6-en-4 α -ol	[3.37]*		Sesquiterpenic alcohol
Rosifoliol	0.60	0.26	Sesquiterpenic alcohol
Unknown	1.10		Unknown
Unknown	0.36	0.45	Oxygenated sesquiterpene
Unknown	2.37*	1.82	Sesquiterpenic alcohol
10-epi- β -Acorenol?	[2.37]*		Sesquiterpenic alcohol
Unknown	3.15*		Oxygenated sesquiterpene
Cyclocopacamphan-12-ol, epimer A	[3.15]*	1.02	Sesquiterpenic alcohol
Cyclocopacamphan-12-ol, epimer B	1.13	1.61	Sesquiterpenic alcohol
Zizanol	2.54	1.69	Sesquiterpenic alcohol
Khusiol	2.46*	1.79	Sesquiterpenic alcohol
epi-Zizanone	[2.46]*	0.40	Sesquiterpenic ketone
Zizanal?	1.04	1.02*	Sesquiterpenic aldehyde
Unknown	0.35	0.36	Oxygenated sesquiterpene
Unknown	1.42*		Oxygenated sesquiterpene
Unknown	[1.42]*		Oxygenated sesquiterpene
Vetiselinenol	2.60	2.38	Sesquiterpenic alcohol
α -Vetivol?	0.28		Sesquiterpenic alcohol
Unknown	0.15		Oxygenated sesquiterpene
Khusimol	11.59*	10.76*	Sesquiterpenic alcohol
Oplopanone	[11.59]*	0.14	Sesquiterpenic alcohol
10-epi-Acora-3,11-dien-15-al?	1.05		Sesquiterpenic aldehyde
Unknown	0.17		Oxygenated sesquiterpene
Unknown	0.34	0.40	Oxygenated sesquiterpene
β -Costol	0.44	0.25	Sesquiterpenic alcohol
(<i>E</i>)-Isovalencenol	5.22	4.94	Sesquiterpenic alcohol
Nootkatone	0.62*	[10.76]*	Sesquiterpenic ketone
Unknown	[0.62]*		Oxygenated sesquiterpene
(<i>Z</i>)-Isovalencenal	1.11	0.54	Sesquiterpenic aldehyde
β -Vetivone	3.16	1.77	Sesquiterpenic ketone
Zizanoic acid	2.01	3.41	Sesquiterpenic acid
(<i>E</i>)-Isovalencenal	0.96	[1.02]*	Sesquiterpenic aldehyde
α -Vetivone	1.73	1.73	Sesquiterpenic ketone
β -Cyclodihydrocostunolide?	0.14		Sesquiterpenic lactone
Total identified	73.34%	54.01%	

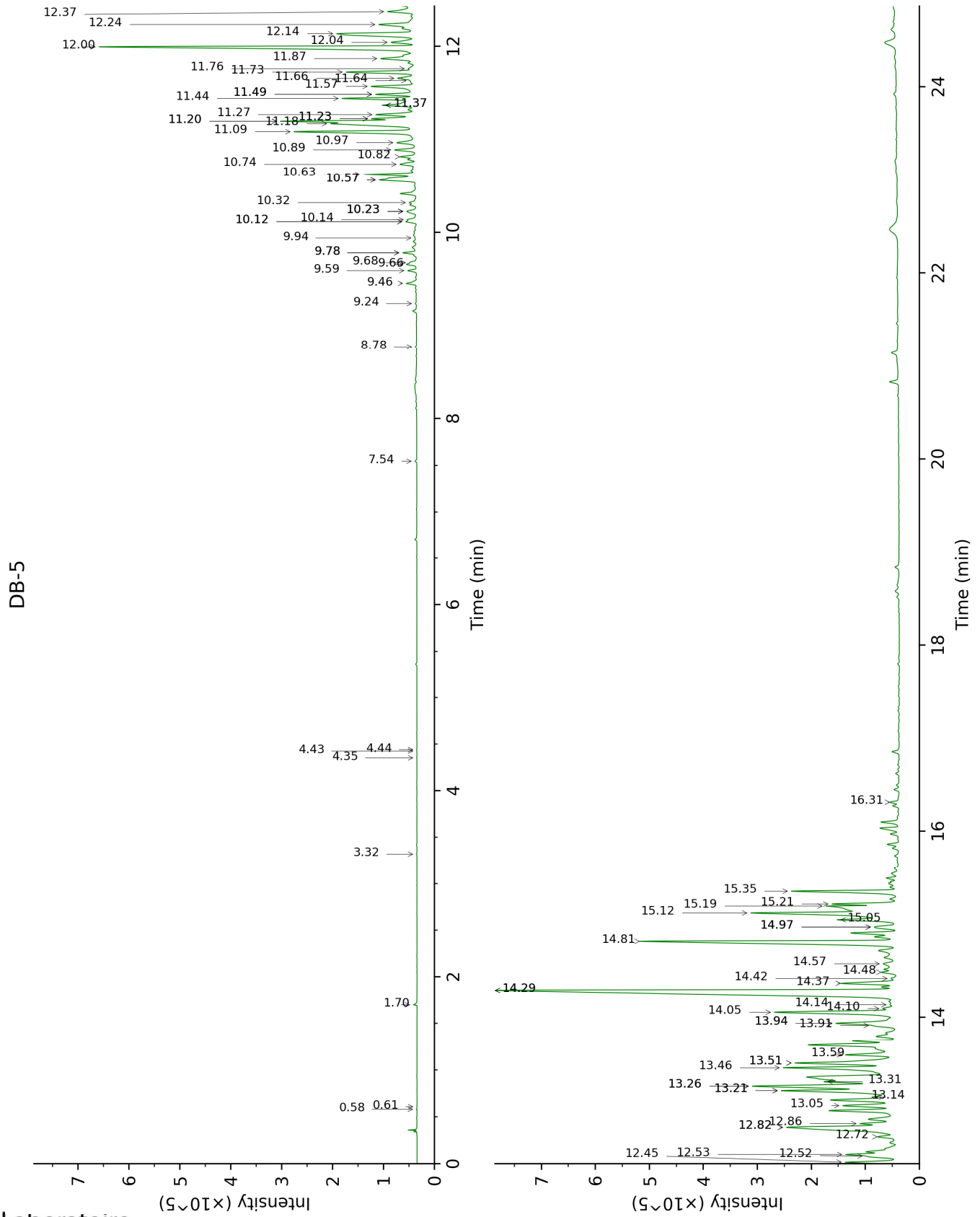
*: Two or more compounds are coeluting on this column

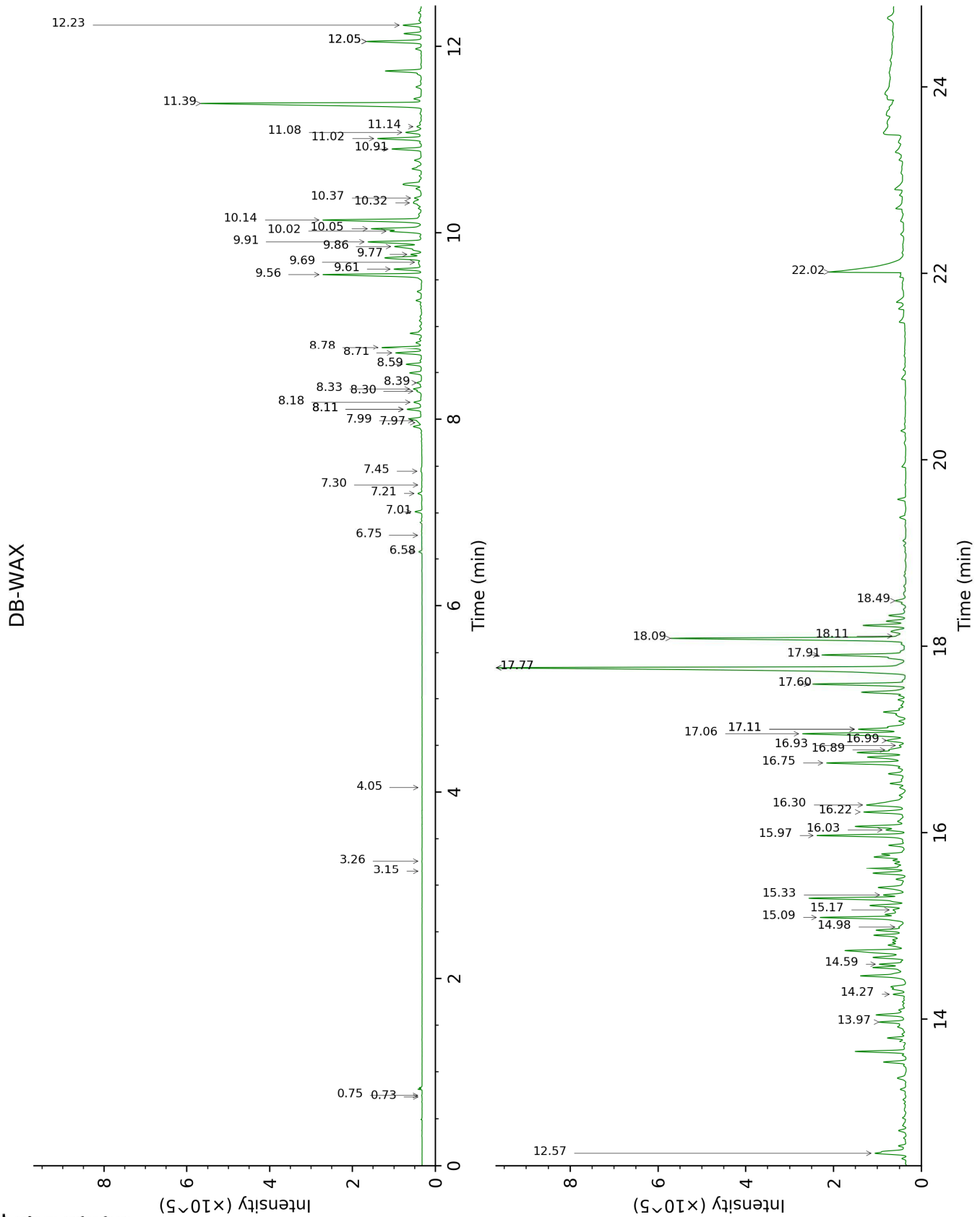
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.58	640	tr	0.75	886	tr
2-Methylbutyral	0.61	650	tr	0.73	880	tr
Furfural	1.70	827	0.04	6.58	1410	0.05
Benzaldehyde	3.32	952	tr	7.30	1464	tr
para-Cymene	4.35	1021	tr	4.05	1228	tr
Limonene	4.43	1025	tr	3.15	1160	tr
β-Phellandrene	4.44	1026	tr	3.26	1169	tr
Coumaran	7.54	1226	0.02	16.93	2330	0.15
4-Vinylguaiacol	8.78	1309	0.01	14.98	2128	0.23
α-Cubebene	9.24	1342	0.02	6.75	1423	0.01
Unknown [m/z 145, 188 (95), 117 (91), 173 (80), 91 (65), 131 (64)]	9.46	1357	0.17			
α-Ylangene	9.59	1367	0.12	7.01	1443	0.12
2-Norzizaene?	9.66	1371	0.15			
2-epi-α-Funebrene	9.68	1373	0.09	7.21	1457	0.07
Nigritene	9.78*	1380	0.22	8.11*	1525	0.29
Unknown [m/z 145, 146 (35), 131 (42), 117 (22), 173 (22), 91 (20)... 188 (6)]	9.78*	1380	[0.22]			
Cyperene	9.94	1391	0.02	7.45	1475	0.02
α-Cedrene	10.12*	1404	0.16	7.97	1514	0.04
Acora-3,7(14)-diene	10.12*	1404	[0.16]	8.18	1531	0.20
β-Funebrene	10.14	1405	0.14	8.11*	1525	[0.29]
Aristolene	10.23*	1412	0.22	7.99	1516	0.08
β-Caryophyllene	10.23*	1412	[0.22]	8.39	1547	0.10
β-Cedrene	10.23*	1412	[0.22]	8.30	1540	0.10
β-Copaene	10.32	1419	0.13	8.33	1542	0.16
6,9-Guaiadiene	10.57*	1437	0.88	8.59	1563	0.29
Prezizaene	10.57*	1437	[0.88]	8.71	1572	0.50
Khusimene	10.63	1442	0.76	8.78	1577	0.74
Unknown [m/z 105, 161 (78), 93 (70), 133 (67), 91 (66), 204 (63), 119 (41)]	10.74	1450	0.32			
Unknown [m/z 119, 190 (99), 175 (95), 105 (71), 91 (59), 120 (57)... 204 (2)]	10.82	1456	0.26			
Unknown [m/z 119, 120 (31), 83 (23), 105 (22), 91 (21), 81 (18)... 202 (9)]	10.89	1462	0.38			
Unknown [m/z 145, 202 (85), 159 (64), 187 (39), 131 (35), 117 (34)]	10.97	1468	0.43			
α-Amorphene	11.09	1476	2.11	9.56	1640	1.96
α-Vetispirene	11.18†	1483	4.15	10.02	1678	0.59
β-Vetispirene	11.20*†	1485	[4.15]	10.14	1687	2.00
cis-Eudesma-6,11-diene	11.20*†	1485	[4.15]	9.69	1650	0.13
γ-Amorphene	11.23*†	1487	[4.15]	9.77	1657	0.19

δ-Selinene	11.23*†	1487	[4.15]	9.61	1644	0.52
Bicyclosesquiphellandrene?	11.27	1490	0.72	9.86	1664	0.69
Unknown [m/z 131, 145 (59), 202 (55), 187 (31), 91 (26), 159 (24)]	11.37*	1497	0.54			
Eudesma-2,4(15),11-triene	11.37*	1497	[0.54]	11.08	1767	0.38
δ-Amorphene	11.44	1503	1.10	9.91	1668	1.16
γ-Cadinene	11.49*	1506	0.62	10.32	1702	0.16
Nootkatene	11.49*	1506	[0.62]	10.91	1752	0.54
Spirovetiva-1(10),7(11)-diene	11.57	1513	0.92	10.05	1680	1.00
δ-Cadinene	11.64	1518	0.11	10.37	1706	0.16
trans-Calamenene	11.66	1520	0.39	11.14	1772	0.10
γ-Vetivenene	11.73	1525	1.14	11.02	1761	0.86
(6S,10R)- Dimethylbicyclo[4.4.0]decan- 1-en-3-one?	11.76	1528	0.11			
α-Calacorene	11.87	1536	0.72	12.06*	1852	1.01
β-Vetivenene	12.00	1546	5.52	11.39	1793	5.18
α-Elemol	12.04	1550	0.51	13.97	2029	0.54
cis-Eudesm-6-en-11-ol	12.14	1557	1.90			
Unknown [m/z 81, 200 (55), 143 (36), 93 (33), 91 (32), 185 (31), 129 (27), 128 (21)...]	12.24	1565	0.74			
Unknown [m/z 59, 43 (56), 205 (47), 91 (41), 220 (32), 105 (30), 147 (21)]	12.37	1576	0.65			
Unknown [m/z 202, 187 (63), 145 (43), 159 (34), 131 (29), 91 (22), 117 (20)]	12.45	1582	0.90	12.06*	1852	[1.01]
Unknown [m/z 161, 119 (78), 105 (75), 120 (72), 43 (64)... 218 (4)]	12.52	1587	0.40	12.23	1867	0.36
Khusimone?	12.53	1589	0.78			
Unknown [m/z 179, 161 (66), 119 (44), 95 (38), 105 (35)... 204 (24), 222 (1)]	12.72	1604	0.44	14.59	2088	0.51
Unknown [m/z 187, 202 (86), 145 (25), 131 (19), 105 (16), 188 (15)]	12.82*	1612	3.37	12.57	1898	0.56
Selin-6-en-4α-ol	12.82*	1612	[3.37]			
Rosifolliol	12.86	1615	0.60	14.27	2057	0.26
Unknown [m/z 145, 59 (97), 161 (87), 218 (76), 43 (76), 179 (63)...]	13.05	1631	1.10			
Unknown [m/z 121, 107 (69), 93 (64), 79 (60), 177 (59), 136 (58), 91 (57), 41 (56)... 220 (21)]	13.14	1638	0.36	15.33	2162	0.45
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.21*	1644	2.37	15.09	2138	1.82

10-epi- β -Acorenol?	13.21*	1644	[2.37]			
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.26*	1648	3.15			
Cyclocopacamphan-12-ol, epimer A	13.26*	1648	[3.15]	16.22	2254	1.02
Cyclocopacamphan-12-ol, epimer B	13.31	1652	1.13	16.30	2262	1.61
Zizanol	13.46	1664	2.54	16.75	2310	1.69
Khusiol	13.51*	1668	2.46	15.97	2228	1.79
epi-Zizanone	13.51*	1668	[2.46]	15.17	2146	0.40
Zizanal?	13.59	1676	1.04	17.11*	2349	1.02
Unknown [m/z 189, 159 (82), 133 (44), 91 (29), 105 (29), 205 (25)... 220 (13)]	13.91	1702	0.35	16.89	2325	0.36
Unknown [m/z 91, 105 (66), 133 (48), 159 (46), 117 (39), 119 (34), 189 (34)... 220 (12)]	13.94*	1704	1.42			
Unknown [m/z 204, 189 (99), 43 (83), 161 (75), 105 (55), 91 (44), 119 (33)... 220 (13)]	13.94*	1704	[1.42]			
Vetiselinenol	14.06	1714	2.60	17.06	2344	2.38
α -Vetivol?	14.10	1718	0.28			
Unknown [m/z 136, 121 (98), 137 (90), 119 (68), 107 (55), 135 (55)... 202 (30), 220 (27)]	14.14	1722	0.15			
Khusimol	14.29*	1735	11.59	17.77*	2422	10.76
Oplopanone	14.29*	1735	[11.59]	18.11	2460	0.14
10-epi-Acora-3,11-dien-15-al?	14.36	1741	1.05			
Unknown [m/z 91, 105 (89), 79 (84), 93 (77), 107 (67), 189 (64), 145 (62), 119 (61)... 220 (16)...]	14.42	1746	0.17			
Unknown [m/z 91, 175 (51), 105 (47), 133 (50)... 218 (20), 232? (1)]	14.48	1752	0.34	16.03	2234	0.40
β -Costol	14.57	1760	0.44	18.49	2502	0.25
(<i>E</i>)-Isovalencenol	14.82	1781	5.22	18.09	2457	4.94
Nootkatone	14.97*	1794	0.62	17.77*	2422	[10.76]
Unknown [m/z 202, 187 (91), 93 (70), 91 (69), 105 (67)...]	14.97*	1794	[0.62]			
(<i>Z</i>)-Isovalencenal	15.05	1801	1.11	16.99	2336	0.54
β -Vetivone	15.12	1807	3.16	17.60	2402	1.77
Zizanoic acid	15.19	1814	2.01	22.02	2938	3.41
(<i>E</i>)-Isovalencenal	15.21	1816	0.96	17.11*	2349	[1.02]
α -Vetivone	15.35	1828	1.73	17.91	2437	1.73
β -Cyclodihydrocostunolide?	16.31	1916	0.14			
Total identified		73.34%			54.01%	
Total reported		80.49%			58.48%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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