

## APPENDIX A

Table A.1. Identified components of *Cymbopogon citratus* oil

No.	Components	Mass %
1	2,6 Dimethyloctane	0.1
2	<b>Myrcene</b>	<b>25.3</b>
3	Z- $\beta$ -Ocimene	1.0
4	E- $\beta$ -Ocimene	0.7
5	p-Cymene	0.5
6	trans-allo-Ocimene	0.1
7	Tetrahydrolinalool	0.3
8	Fenchone	0.2
9	Citronellal	0.3
10	$\beta$ -Patchoulene	0.2
11	Linalool	0.6
12	Camphor	0.1
13	<b>Neomenthol</b>	<b>3.3</b>
14	Terpinen-1-ol	0.4
15	<b>Linalyl acetate</b>	<b>2.3</b>
16	$\beta$ -Caryophyllene	0.3
17	<b>Neral</b>	<b>26.5</b>
18	Sabinol	0.1
19	<b>Geranial</b>	<b>33.7</b>
20	Nerol	0.8
21	Geraniol	1.9

Ref. E.A. Weiss, Essential Oil Crops, CAB International, 1997

**Table A.2.** Identified components of *Cymbopogon flexuosus* oil.

No.	Components	Mass %
1	$\alpha$ -Pinene	0.06-2.67
2	<b>Camphene</b>	<b>0.07-13.46</b>
3	$\beta$ -Pinene	0.1
4	Myrecene	1.93-4.33
5	$\alpha$ -Phellandrene	0.05-0.16
6	Limonene	0.035-3.03
7	$\beta$ -Phellandrene	0.11-0.40
8	(Z)- $\beta$ -Ocimene	0.05-0.20
9	<b>(E)-<math>\beta</math>-Ocimene</b>	<b>0.82-20.09</b>
10	<b><math>\gamma</math>-Terpinene</b>	<b>0.21-9.91</b>
11	Terpinolen	0.10-0.43
12	Citronellal	0.06-0.18
13	Linalool	0.77-9.95
14	<b>Neral</b>	<b>1.84-10.42</b>
15	$\alpha$ -Terpineol	0.06-1.42
16	Borneol	0.28-4.85
17	<b>Geranial</b>	<b>1.82-15.03</b>
18	Geranyl acetate	0.62-7.74
19	Citronellol	0.23-1.24
20	Nerol	0.14-0.32
21	<b>Geraniol</b>	<b>3.0-74.72</b>

Ref. E. Chishowa, D.R. Hall, D.I. Farman, Flavour and Frag. J., 13 (1998) 29-30

**Table A.3.** Identified components of *Tagetes minuta* oil.

No.	Components	%
1	$\alpha$ -Pinene	0.06
2	Ethyl-2-methylbutyrate	0.08
3	Sabinene	0.96
4	Myrecene	0.1
5	$\alpha$ -Phellandrene	0.09
6	$\alpha$ -Terpinene	0.02
7	Limonene	7.24
8	$\beta$ -Phellandrene	0.07
9	(E)-2-hexanal	0.06
<b>10</b>	<b>(Z)-<math>\beta</math>-Ocimene</b>	<b>28.49</b>
11	$\gamma$ -Terpinene	0.05
12	(E)- $\beta$ -Ocimene	0.39
<b>13</b>	<b>Dihydrotagetone</b>	<b>30.3</b>
14	allo-ocimene	0.32
15	(Z)-Tagetone	0.25
16	Decanal	0.12
17	(E)-Tagetone	4.8
18	$\beta$ -Caryophyllene	0.47
19	(Z)-Tagetonone	1.87
<b>20</b>	<b>(E)-Tagetonone</b>	<b>15.35</b>
21	Bicyclogermacrene	0.1
22	isopiperitenone	0.26

Ref. J. Chalchat, R.P. Granny, A. Muhayimana, J. Essent. Oil Res. 7 (1995) 375-386

**Table A.4.** Identified components of *Artemisia afra* oil.

No.	Components	Mass %
1	Tricyclene	0.1-0.2
2	$\alpha$ -Pinene + $\alpha$ -Thujone	0.4-1.1
3	$\alpha$ -Fenchene	0.1-1.0
4	<b>Camphene</b>	<b>0.3-3.9</b>
5	$\beta$ -Pinene	0.1-0.7
6	Sabinene	0.1-1.1
7	Myrcene	0.1-1.1
8	$\alpha$ -Terpinene	0.1-1.1
9	Dehydro-1,8-cineol	0.1-0.2
10	Limonene	0.1-0.5
11	<b>1,8-Cineol</b>	<b>0.1-27.9</b>
12	( <i>E</i> )- $\beta$ -Ocimene	0.1-0.3
13	$\gamma$ -Terpinene	0.3-1.9
14	p-Cymene	0.3-2.0
15	Terpinolene	0.1-0.5
16	<b>Artemisia ketone</b>	<b>6.3-41.9</b>
17	<b>Santolina alcohol</b>	<b>3.1-10.1</b>
18	$\alpha$ -Thujone	1.0-2.9
19	Artemisyl acetate	0.1
20	$\beta$ -Thujone	Trace
21	cis-Sabinene hydrate	0.2-0.5
22	Artemisia alcohol	0.3
23	<b><math>\alpha</math>-Caopaene</b>	<b>8.5-27.1</b>
24	trans-Sabinene hydrate	1.8-4.4
25	cis-p-menth-2-en-1-ol	0.2-0.4
26	Bornyl acetate	0.3-1.5
27	$\beta$ -Caryophyllene	0.5-2.3
28	Terpinen-4-ol	0.1
29	Myrtenal	0.1
30	Trans-p-meth-2-en-1-ol	0.2-0.3
31	$\delta$ -Terpineol	0.1-2.5
32	<b>Borneol</b>	<b>0.6-3.4</b>

Ref. E.A. L.S. Chagonda, C. Makanda, J-Claude Chalchat, Flavour and Frag. J., 14 (1999) 140-142.

**Table A.4.** Identified constituents of *Artemisia afra* oil.

33	$\alpha$ -Terpineol	0.1-2.5
34	Bicyclogermacrene	0.2-0.5
35	Piperitol	0.1-0.7
36	$\delta$ -Cadinene	0.5.-0.8
37	Cuminaldehyde	0.5
38	Myrtenol	0.1
39	Calamenene	0.1-0.9
40	Cis-Carveol	0.1
41	trans-Caryophyllene oxide	0.1
42	Methyl linolenate	0.1
43	Germacene-D-4-ol	0.1
44	P-Cymen-8-ol	0.1
45	Spathulenol	0.1
46	T-muurolol	0.5
47	Intermomedeol	0.4

Ref: L.S. Chagonda, C. Makanda, J-Claude Chalchat, Flavour and Frag. J., 14 (1999) 140-142.

**Table A.4.** Identified constituents of *Pelargonium capitatum X radens* oil.

no.	Components	%
1	$\alpha$ -Pinene	1.00
2	Myrecene	0.30
3	<i>cis</i> - $\beta$ -Ocimene	0.30
4	<i>cis</i> -Rose oxide	0.20
5	<i>trans</i> -Rose oxide	Ng
6	<b>Linalool</b>	<b>4.60</b>
7	Menthone	0.40
8	<b>Isomenthone</b>	<b>7.80</b>
9	$\alpha$ -terpineol	0.30
10	<b>Citronellol</b>	<b>19.00</b>
11	<b>Geraniol</b>	<b>21.50</b>
12	Geranial	Ng
13	<i>trans</i> -Citral	1.10
14	<b>Citronellyl formate</b>	<b>8.50</b>
15	<b>Geranyl formate</b>	<b>9.50</b>
16	Geranyl acetate	0.50
17	$\beta$ -Bourbonene	0.70
18	$\beta$ -Caryophyllene	0.80
19	Citronellyl propionate	0.20
20	<b>Guaiadiene 6,9</b>	<b>7.20</b>
21	Geranyl propionate	1.60
22	Germacrene D	2.30
23	Citronellyl butyrate	1.00
24	Geranyl butyrate	1.20
25	Phenylethyl tilgate	0.70
26	Citronellyl tilgate	0.10
27	Geranyl tilgate	1.30
28	Geranyl tilgate	1.30

Ref. E.A. Weiss, Essential Oil Crops, CAB International, 1997

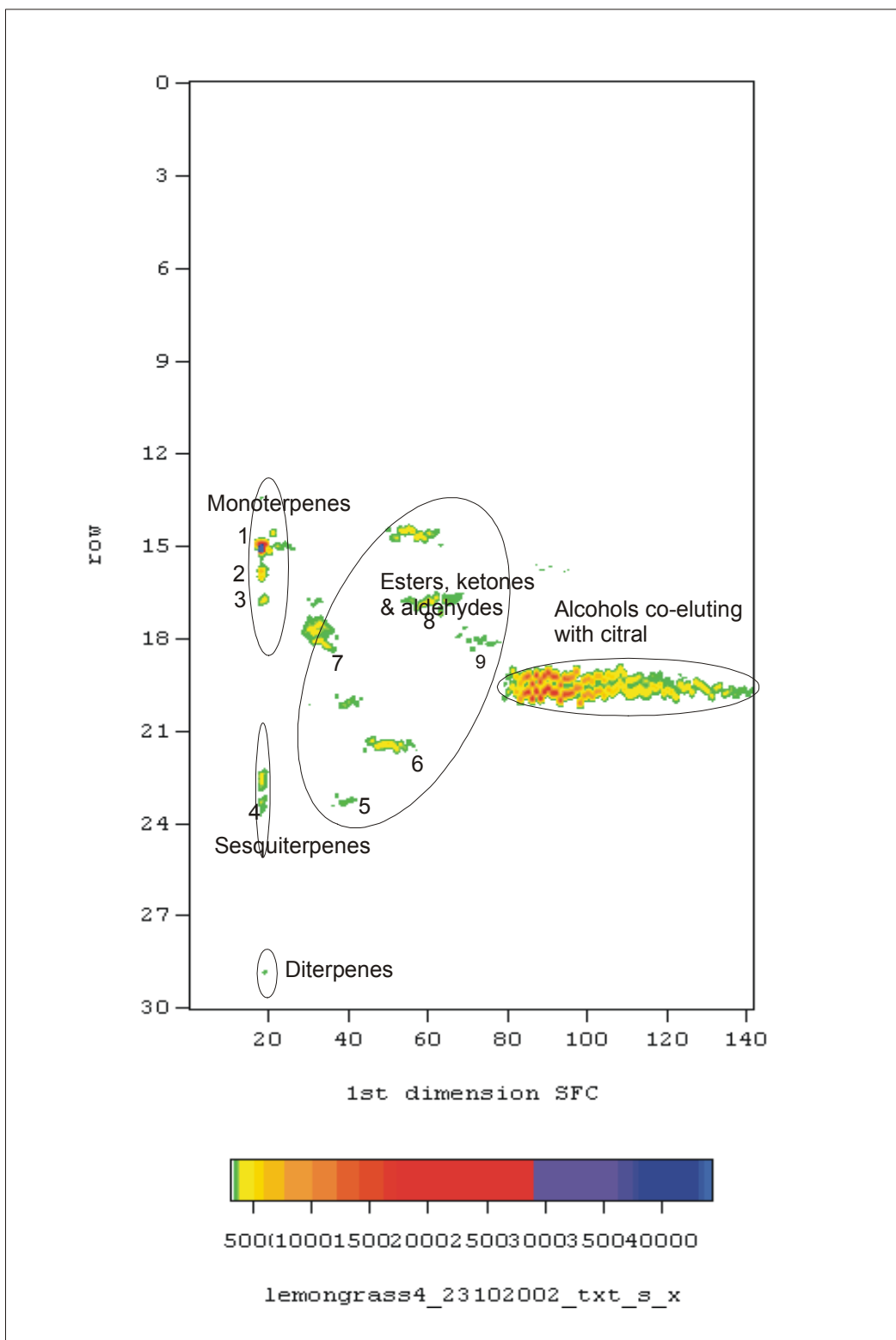
**Table A.6** Reproducibility results of SFCxGC run-to-run of *C. citratus* oil for second dimension retention.

Peak no.	2tr1	2tr2	2tr3	2tr4	Mean	STD	%RSD
1	14.91	14.95	14.90	14.89	14.91	0.02	0.15
2	15.20	15.85	15.75	15.57	15.59	0.25	1.59
3	16.40	16.50	16.70	16.46	16.52	0.11	0.68
5	23.03	22.85	22.75	23.07	22.93	0.13	0.57
6	21.14	20.10	19.55	21.04	20.46	0.66	3.24
7	18.25	17.91	17.85	17.93	17.99	0.16	0.78
9	18.00	16.80	16.25	17.93	17.25	0.75	4.31
8	15.80	14.60	14.10	15.07	14.89	0.63	4.21
						<b>0.34</b>	<b>1.94</b>

**Table A.7** Reproducibility results of SFCxGC run-to-run of *C. citratus* oil for first dimension retention

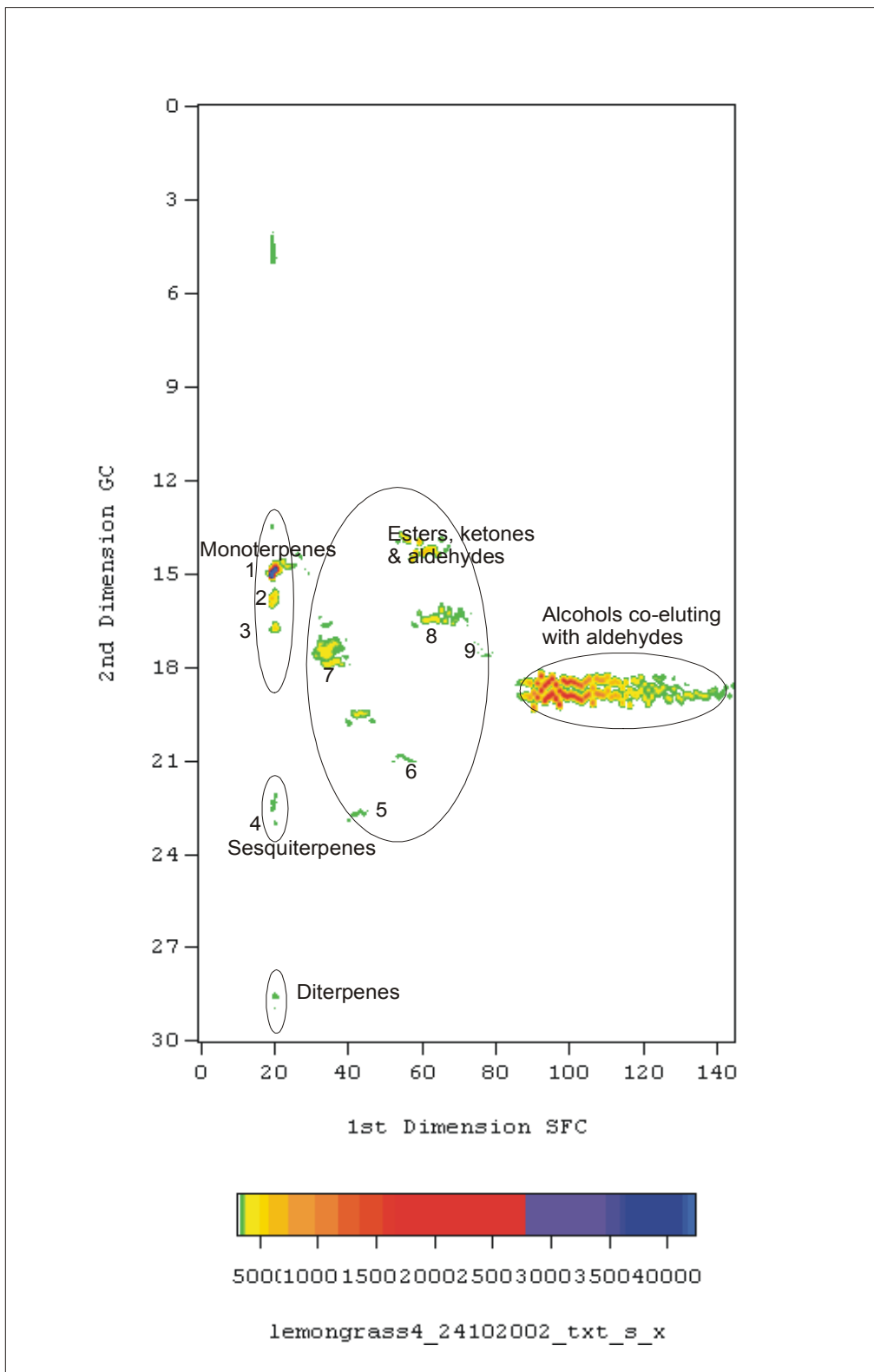
Peak no.	1tr1	1tr2	1tr3	1tr4	Mean	STD	%RSD
1	22.10	18.50	19.50	19.97	20.20	1.31	6.57
2	22.50	19.00	20.00	21.05	20.64	1.30	6.28
3	21.90	18.50	20.10	21.03	20.38	1.26	6.18
5	44.50	39.50	42.25	43.45	42.43	1.87	4.40
6	49.00	40.50	43.50	45.30	44.58	3.08	6.90
7	40.50	33.50	34.50	35.09	35.90	2.72	7.57
9	72.00	61.50	65.50	67.26	66.57	3.77	5.66
8	66.50	57.00	59.50	61.49	61.49	3.49	5.71
						<b>2.35</b>	<b>6.16</b>

## APPENDIX B



**Figure B.1** SFCxGC chromatogram of *Cymbopogon citratus* sample 4 (run 1)





**Figure B.2** SFCxGC chromatogram of *Cymbopogon citratus* sample 4 (run 2)

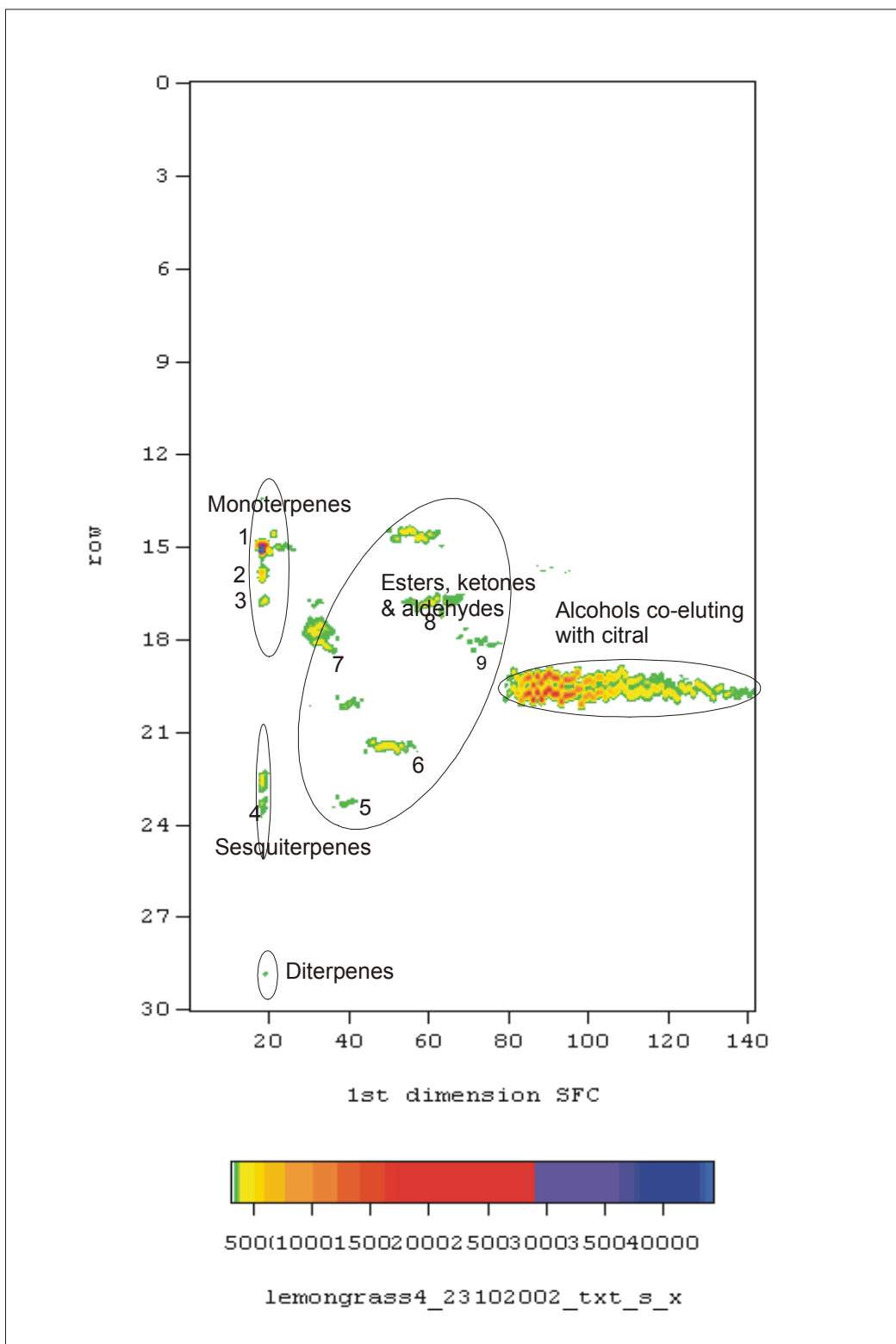
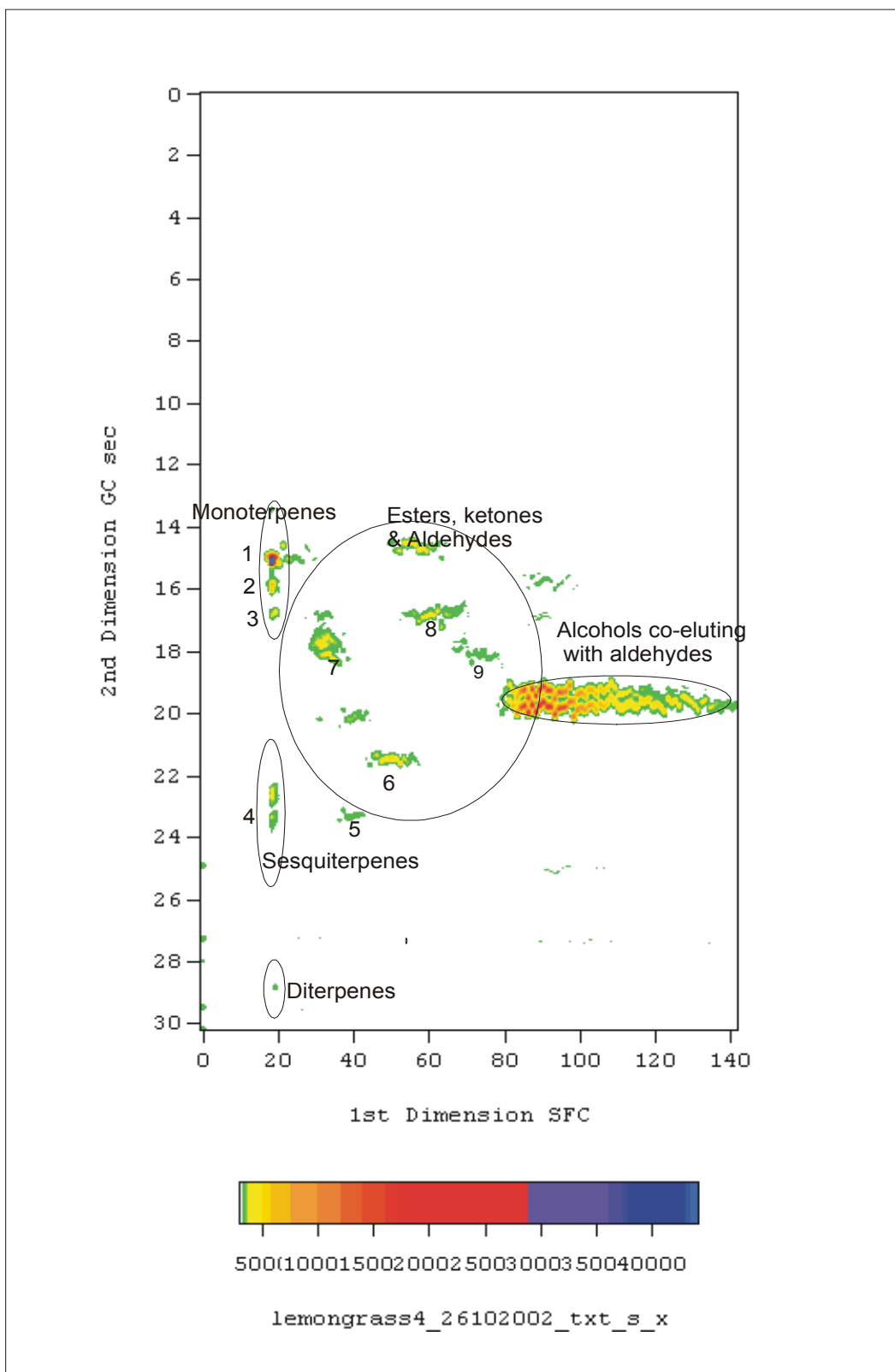


Figure B.3 SFCxGC chromatogram of *Cymbopogon citratus* sample 4 (run 3)

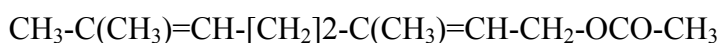


**Figure B.4** SFCxGC chromatogram of *Cymbopogon citratus* sample 4 (run 4)

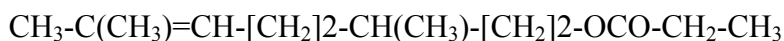
## APPENDIX C

## Some of essential oil components chemical structures

1. Geranyl acetate : (E)-3,7-dimethyl-2,6-octadien-1-yl ethanoate



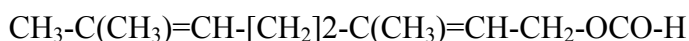
2. Citronellyl propionate : 3,7-dimethyl-6-octen-1-yl propanoate



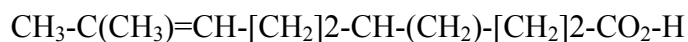
3. Geranyl propionate : (E)-3,7-dimethyl-2,6-octadien-1-yl propanoate



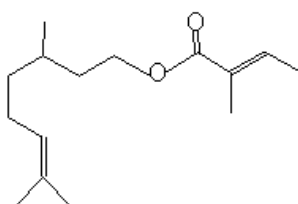
4. Geranyl formate : (E)-3,7-dimethyl-2,6-octadien-1-yl methanoate



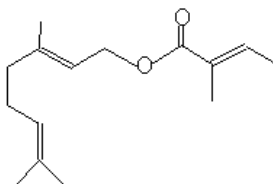
5. Citronellyl formate : 3,7-dimethyl-6-octen-1-yl methanoate



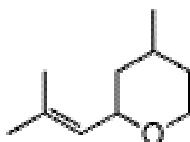
6. Citronellyl tiglate : 2,6 Dimethyl Octenyl Tiglate



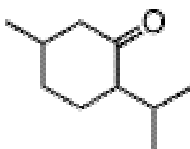
7. Geranyl tiglate : 3,7, Dimethyl-2,6-Octadien-1-yl-Tiglate



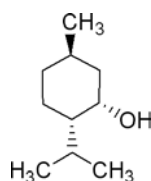
8. (-)-cis-rose oxide: tetrahydro-4-methyl-2-(2-methyl-1-propenyl)-2,5-cis-2H-pyran,



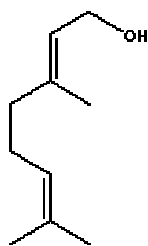
9. Menthone : 5-Methyl-2-(1-methylethyl)cyclohexanone



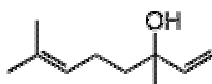
10. Neomenthol :



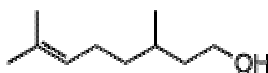
11. Geraniol :  $(\text{CH}_3)_2\text{CCH}(\text{CH}_2)_2\text{C}(\text{CH}_3)\text{CHCH}_2\text{OH}$



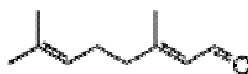
12. linalool : 3,7-dimethylocta-1,6-dien-3-ol, 2,6-dimethylocta-2,7-dien-6-ol (R, S, and racemate)



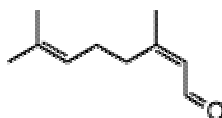
13. citronellol : 3,7-dimethyl-6-octen-1-ol,  $\beta$ -citronellol, (+)-citronellol, rodinol, DL-citronellol



14. geranial : (E)-3,7-dimethyl-2,6-octadienal

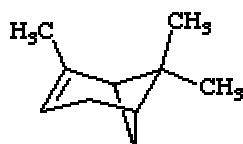


15. neral : 3,7-dimethyl-(Z)-2,6-octadienal



16. (-)-a-Pinene : (1S,5S)-2,6,6-trimethylbicyclo[3.1.1]hept-2-ene

(-)-b-Pinene : (1S,5S)-6,6-dimethyl-2-methylenebicyclo[3.1.1]heptane



$\alpha$ -pinene



$\beta$ -pinene

17. Camphene : 2,2-dimethyl-3-methylene-bicyclo[2.2.1]heptane; 2,2-dimethyl-3-methylene norborane



