

# 台灣本土樹種精油成分之介紹

◎林業試驗所木材纖維組·何振隆、李淑靜 ◎中興大學森林系·蘇裕昌

## 前言

台灣四面環海，植物林相由熱帶伸展到寒帶，植物種類繁多，堪稱是天然物化學研究之寶庫。台灣本土各樹種精油之研究，於針葉樹方面，許多樹種具有芳香味，然而，其中最著名的為台灣針五木，包括：紅檜(*Chamaecyparis formosensis*)、台灣扁柏(*Chamaecyparis obtusa* var. *formosana*)、台灣肖楠(*Calocedrus formosana*)、台灣杉(*Taiwania cryptomerioides*)和香杉(*Cunninghamia lanceolata* var. *konishii* form *konishii*)等樹種，此等樹種不僅價值高，在植物學、地質演化史、生態學及天然物化學等均具有特殊意義，因此，將這五種樹種選定為台灣最珍貴的五種針葉樹，簡稱為台灣貴重針葉五木或台灣針五木。而於闊葉樹方面，則包括有樟科、桃金娘科、芸香科、薔薇科...等具有芳香成分之樹種。近三年來，本實驗室萃取將近台灣百種本土植物精油，並分析其組成成分及生物活性等，且些許樹種之精油已獲得具體成果，並有多篇研究論文發表於國際期刊上。



圖1 樹種選定(李淑靜 攝)



圖2 萃取精油(李淑靜 攝)



圖3 GC及GC-MS分析精油成分  
(李淑靜 攝)



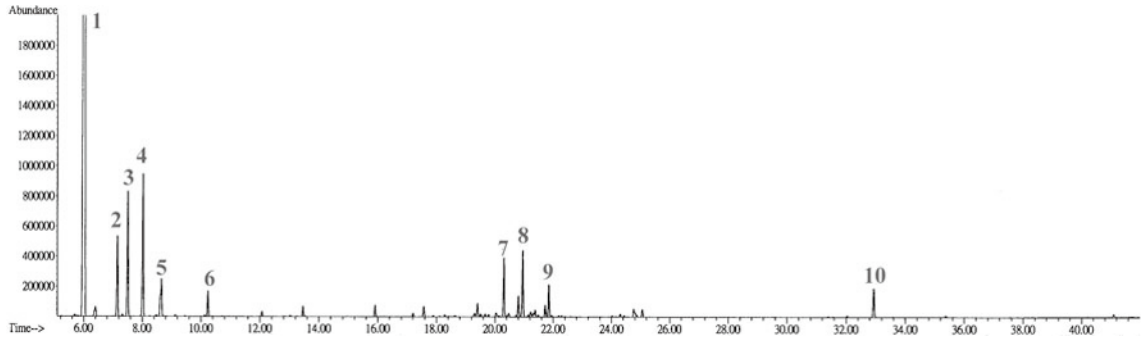
圖4 鑑定精油組成成分(李淑靜 攝)

## 精油成分

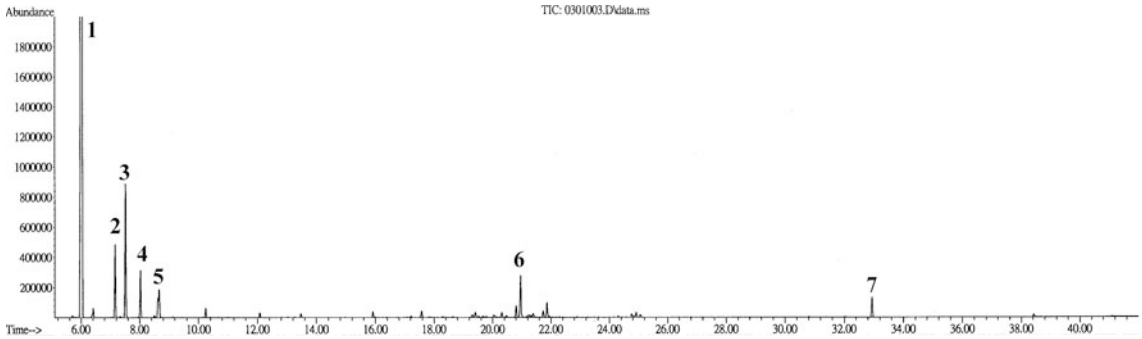
萃取精油及成分分析方法為採取其植物部位，以水蒸餾法萃取精油，且利用氣相層析儀(Gas chromatography, GC)及氣相層析-質譜儀(Gas chromatography mass spectrometry, GC-MS)等分析鑑定組成化合物及含量。於GC及GC-MS分析，為採用HP 6890N GC及5973N MSD，分離管柱為DB5 capillary column(30M × 250 μm × 0.30 μm)，遞載氣體為氮氣，流速為1.0ml/min，分流比為1:10，注射孔溫度為250°C，離子化電壓為70eV，質譜範圍(Mass range)m/z為41–400a.m.u.，分析條件為起始溫度40°C保持2min，以3°C/min之升溫速率上升至250°C。成分鑑定上使用Mass-spectra的比對，採用之資料庫為NIST及Wiley等，並使用KI指數及部分標準品予以比對。於定量上，則以相對面積百分比予以定量。

以下列舉16種植物精油主成分、各分群結構之含量(Monoterpene hydrocarbons、Oxygenated monoterpene hydrocarbons、Sesquiterpene hydrocarbons、Oxygenated sesquiterpene hydrocarbons、Diterpene hydrocarbons及Others等)及收率等，以供大家參考。⊕

1. 紅繪葉精油主成分(採集地：棲蘭山)



2. 台灣扁柏葉精油主成分(採集地：台北信賢苗圃)



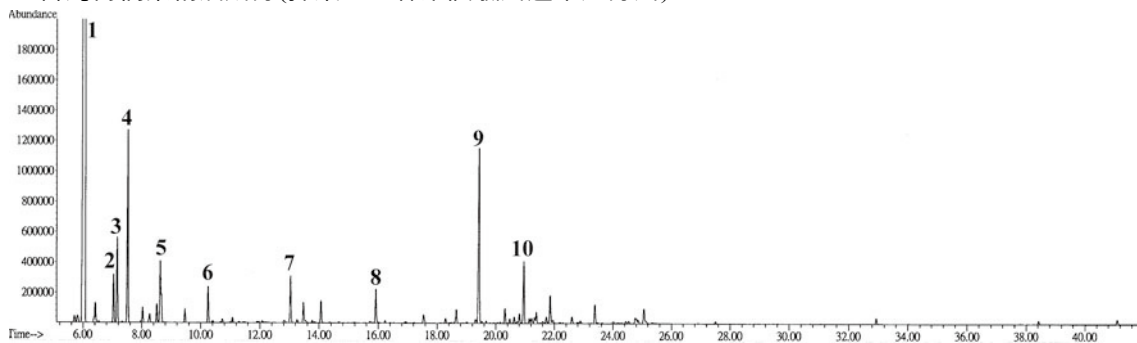
1. 紅繪葉精油主成分(採集地：棲蘭山)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	71.6
2	$\beta$ -pinene	979	2.7
3	$\beta$ -myrcene	991	4.1
4	$\delta$ -2-carene	1002	4.6
5	$\beta$ -phellandrene	1030	1.8
6	terpinolene	1089	0.8
7	$\alpha$ -caryophyllene	1455	2.0
8	$\gamma$ -muurolene	1480	3.1
9	$\delta$ -cadinene	1523	1.1
10	kaurene	2043	1.0
Monoterpene hydrocarbons (%)			86.2
Oxygenated monoterpenes (%)			1.4
Sesquiterpene hydrocarbons (%)			8.8
Oxygenated sesquiterpenes (%)			1.2
Diterpenes (%)			1.1
Others (%)			0.1
Oil Yield (ml/100 g)			0.69 $\pm$ 0.06

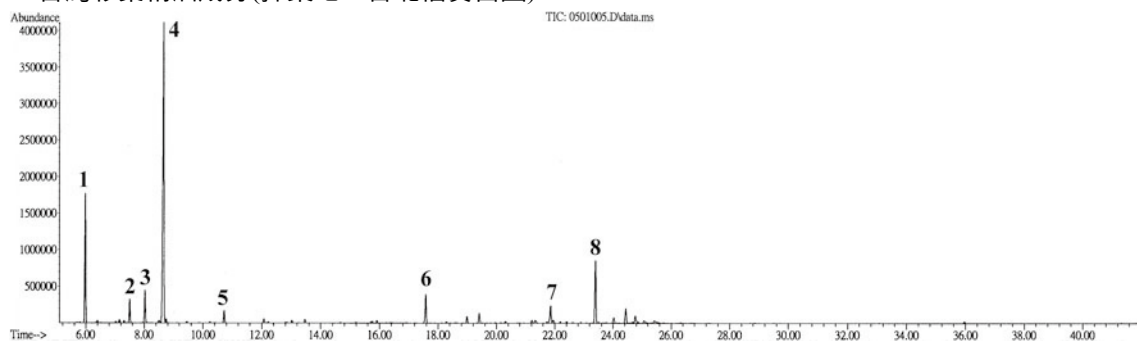
2. 台灣扁柏葉精油主成分(採集地：台北信賢苗圃)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	76.7
2	$\beta$ -pinene	979	3.2
3	$\beta$ -myrcene	991	5.7
4	$\delta$ -2-carene	1002	2.1
5	$\beta$ -phellandrene	1030	2.1
6	$\gamma$ -muurolene	1480	2.8
7	kaurene	2043	1.0
Monoterpene hydrocarbons (%)			90.8
Oxygenated monoterpenes (%)			1.1
Sesquiterpene hydrocarbons (%)			5.8
Oxygenated sesquiterpenes (%)			0.8
Diterpenes (%)			1.1
Others (%)			0.1
Oil Yield (ml/100 g)			0.43 $\pm$ 0.07

3. 台灣肖楠葉精油成分(採集地：林業試驗所蓮華池分所)



4. 台灣杉葉精油成分(採集地：台北信賢苗圃)



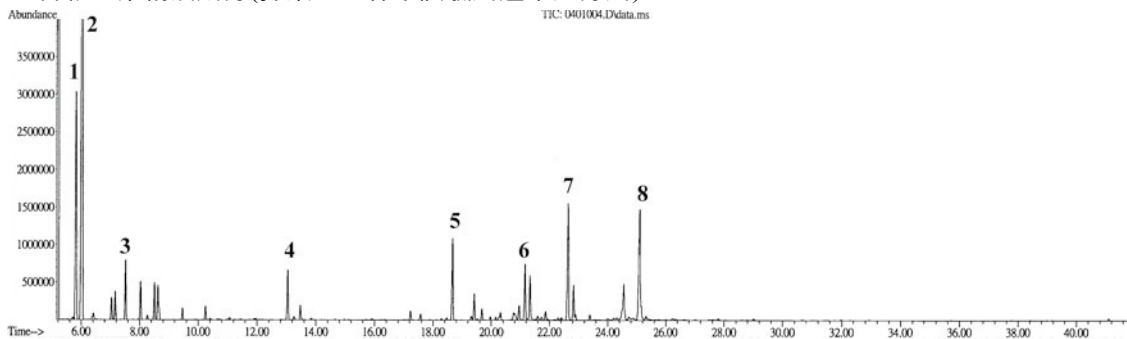
3. 台灣肖楠葉精油成分(採集地：林業試驗所蓮華池分所)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	69.8
2	sabinene	975	1.1
3	$\beta$ -pinene	979	2.0
4	$\beta$ -myrcene	991	4.3
5	limonene	1029	2.0
6	terpinolene	1089	0.8
7	4-terpineol	1177	1.1
8	bornyl acetate	1289	0.9
9	$\beta$ -caryophyllene	1419	4.7
10	$\gamma$ -muurolene	1480	1.9
Monoterpene hydrocarbons (%)			82.2
Oxygenated monoterpenes (%)			4.1
Sesquiterpene hydrocarbons (%)			10.4
Oxygenated sesquiterpenes (%)			2.1
Diterpenes (%)			0.2
Others (%)			0.4
Oil Yield (ml/100 g)			0.63 $\pm$ 0.03

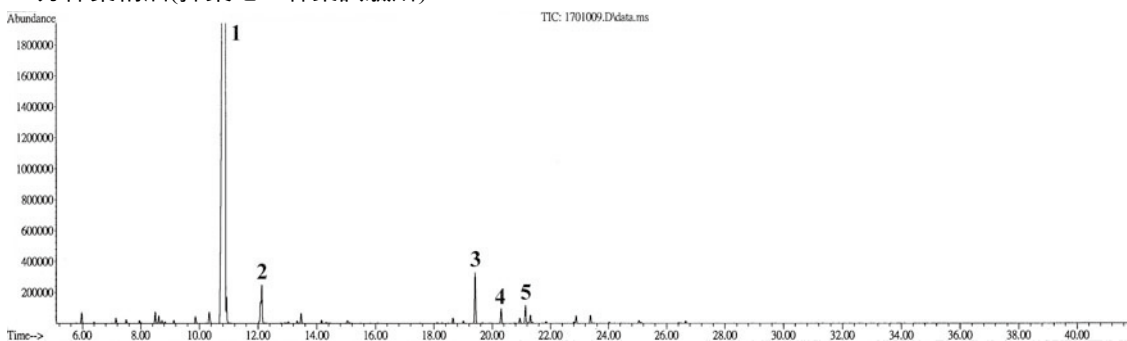
4. 台灣杉葉精油成分(採集地：台北信賢苗圃)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	14.4
2	$\beta$ -myrcene	991	2.6
3	$\delta$ -2-carene	1002	3.9
4	limonene	1029	44.5
5	linalool	1097	1.4
6	$\alpha$ -terpinyl acetate	1349	3.6
7	$\delta$ -cadinene	1523	2.6
8	caryophyllene oxide	1583	8.5
Monoterpene hydrocarbons (%)			67.2
Oxygenated monoterpenes (%)			8.3
Sesquiterpene hydrocarbons (%)			6.7
Oxygenated sesquiterpenes (%)			15.3
Diterpenes (%)			0.0
Others (%)			0.2
Oil Yield (ml/100 g)			0.06 $\pm$ 0.01

5. 香杉之葉精油成分(採集地：林業試驗所蓮華池分所)



6. 芳樟葉精油(採集地：林業試驗所)



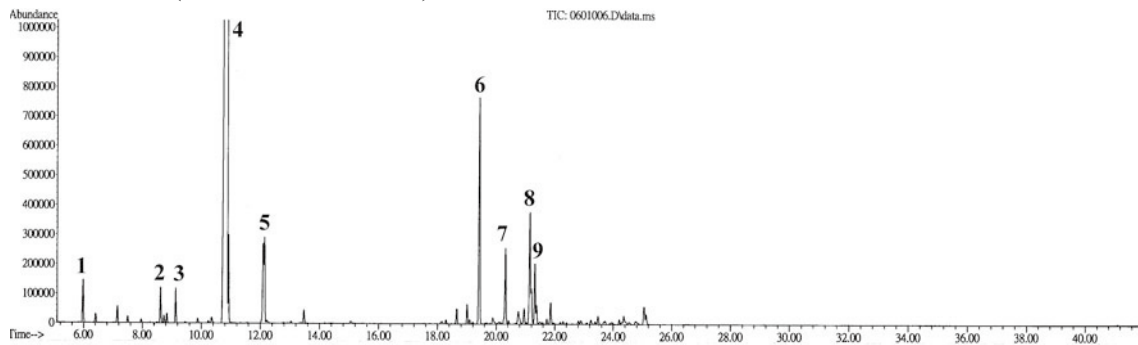
5. 香杉之葉精油成分(採集地：林業試驗所蓮華池分所)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -thujene	930	11.4
2	$\alpha$ -pinene	939	36.4
3	$\beta$ -myrcene	991	2.4
4	4-terpineol	1177	2.2
5	$\beta$ -elemene	1391	3.5
6	$\gamma$ -himachalene	1483	2.7
7	elemol	1550	5.8
8	$\alpha$ -eudesmol	1654	8.1
Monoterpene hydrocarbons (%)			58.9
Oxygenated monoterpenes (%)			3.9
Sesquiterpene hydrocarbons (%)			15.2
Oxygenated sesquiterpenes (%)			18.3
Diterpenes (%)			0.0
Others (%)			0.2
Oil Yield (ml/100 g)			0.46 $\pm$ 0.05

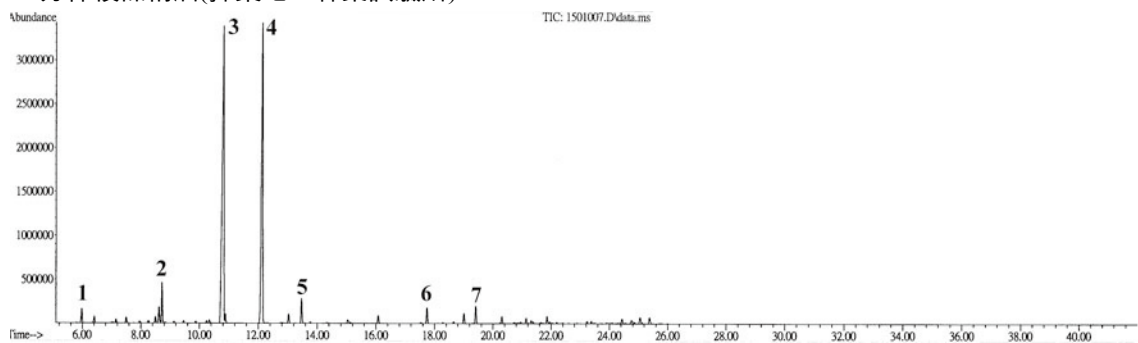
6. 芳樟葉精油(採集地：林業試驗所)

Peak no.	Constituents	K.I.	Concentration (%)
1	linalool	1097	87.3
2	camphor	1146	0.7
3	$\beta$ -caryophyllene	1419	2.1
4	$\alpha$ -caryophyllene	1455	0.6
5	$\beta$ -selinene	1490	0.8
Monoterpene hydrocarbons			1.9
Oxygenated monoterpenes			90.9
Sesquiterpene hydrocarbons			4.6
Oxygenated sesquiterpenes			1.0
Others			0.2
Oil Yield (ml/100 g, v/dry wt)			3.94

7. 芳樟花精油(採集地：林業試驗所)



8. 芳樟枝條精油(採集地：林業試驗所)



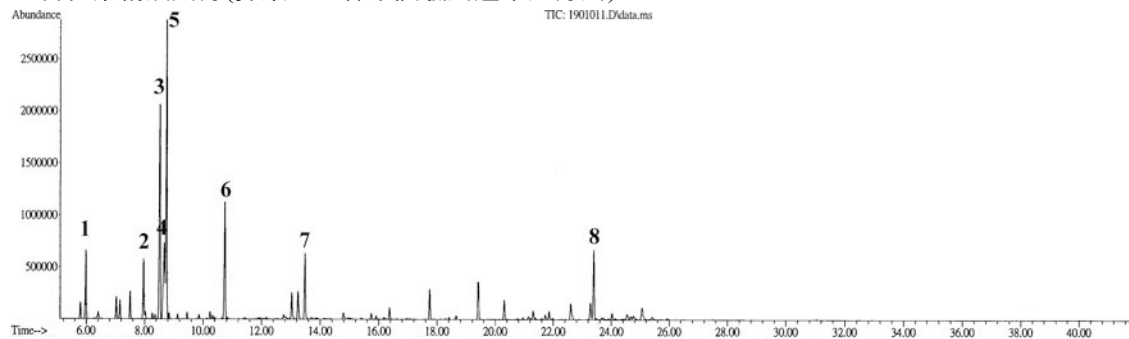
7. 芳樟花精油(採集地：林業試驗所)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	0.9
2	limonene	1029	0.7
3	trans- $\beta$ -ocimene	1050	0.7
4	linalool	1097	72.4
5	camphor	1146	1.7
6	$\beta$ -caryophyllene	1419	5.3
7	$\alpha$ -cayrophyllene	1455	1.8
8	$\beta$ -selinene	1490	2.9
9	$\alpha$ -selinene	1498	1.4
Monoterpene hydrocarbons			3.4
Oxygenated monoterpenes			76.6
Sesquiterpene hydrocarbons			14.7
Oxygenated sesquiterpenes			2.2
Others			0.9
Oil Yield (ml/100 g, v/dry wt)			2.77

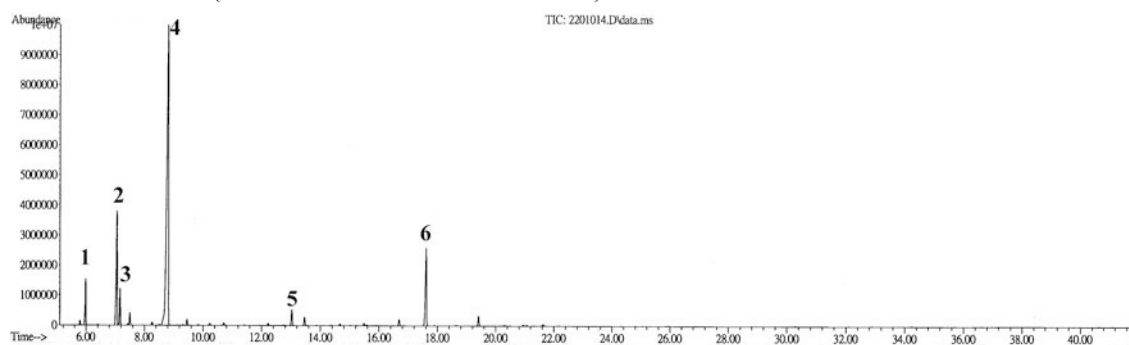
8. 芳樟枝條精油(採集地：林業試驗所)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	1.3
2	1,8-cineole	1031	3.0
3	linalool	1097	41.6
4	camphor	1146	33.5
5	$\alpha$ -terpineol	1189	2.1
6	eugenol	1359	1.3
7	$\beta$ -caryophyllene	1419	1.5
Monoterpene hydrocarbons			5.1
Oxygenated monoterpenes			82.8
Sesquiterpene hydrocarbons			5.1
Oxygenated sesquiterpenes			3.2
Others			3.1
Oil Yield (ml/100 g, v/dry wt)			0.59

9. 香桂葉精油成分(採集地：林業試驗所蓮華池分所)



10. 山胡椒葉精油(採集地：林業試驗所蓮華池分所)



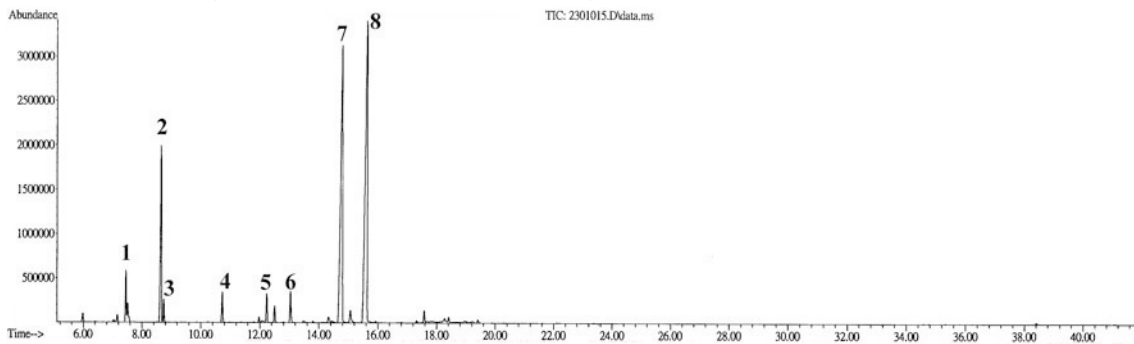
9. 香桂葉精油成分(採集地：林業試驗所蓮華池分所)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	6.3
2	$\beta$ -pinene	979	2.7
3	p-cymene	1025	21.6
4	limonene	1029	5.0
5	1,8-cineole	1031	16.5
6	linalool	1097	11.9
7	$\alpha$ -terpineol	1189	3
8	caryophyllene oxide	1583	6.2
Monoterpene hydrocarbons			40.9
Oxygenated monoterpenes			41.8
Sesquiterpene hydrocarbons			2.6
Oxygenated sesquiterpenes			10.8
Others			4
Oil Yield (ml/100 g, v/dry wt)			0.82

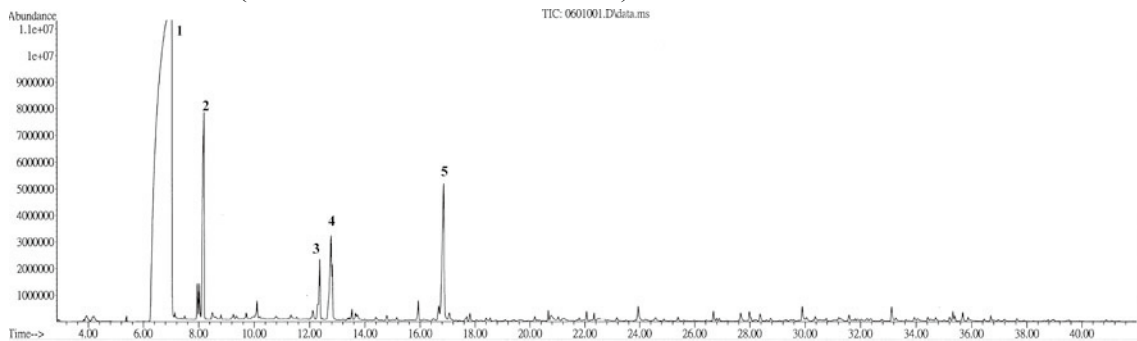
10. 山胡椒葉精油(採集地：林業試驗所蓮華池分所)

Peak no.	Constituents	K.I.	Concentration (%)
1	$\alpha$ -pinene	939	4.1
2	sabinene	976	12.3
3	$\beta$ -pinene	979	3.2
4	1,8-cineol	1031	57.6
5	4-terpineol	1177	1.7
6	$\alpha$ -terpineol acetate	1349	9.8
Monoterpene hydrocarbons			25.1
Oxygenated monoterpenes			72.7
Sesquiterpene hydrocarbons			1.9
Oxygenated sesquiterpenes			0.3
Others			0
Oil Yield (ml/100 g, v/dry wt)			13.93±0.09

11. 山胡椒果精油(採集地：林業試驗所蓮華池分所)



12. 墨點櫻桃葉精油(採集地：林業試驗所蓮華池分所)



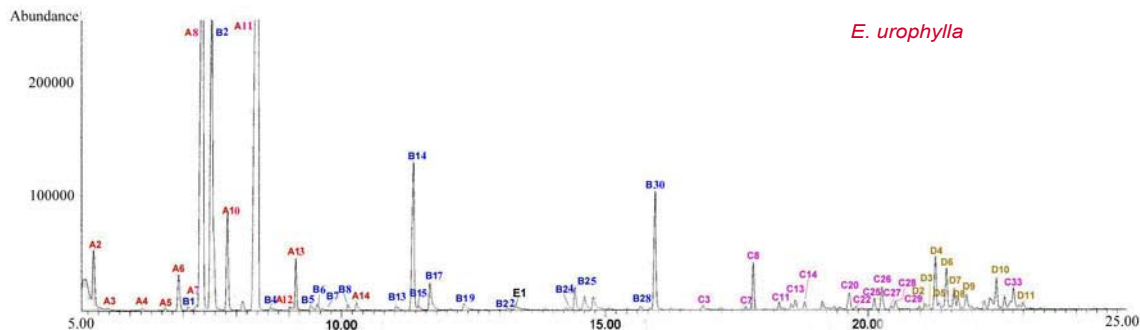
11. 山胡椒果精油(採集地：林業試驗所蓮華池分所)

Peak no.	Constituents	K.I.	Concentration (%)
1	6-methyl-5-hepten-2-one	986	2.6
2	limonene	1029	11.3
3	1,8-cineol	1031	1.1
4	linalool	1097	1.7
5	citronellal	1153	1.7
6	4-terpineol	1177	1.9
7	neral	1238	31.3
8	geranial	1267	37.6
Monoterpene hydrocarbons			13.9
Oxygenated monoterpenes			84.9
Sesquiterpene hydrocarbons			1.2
Oxygenated sesquiterpenes			0
Others			0
Oil Yield (ml/100 g, v/dry wt)			3.97±0.03

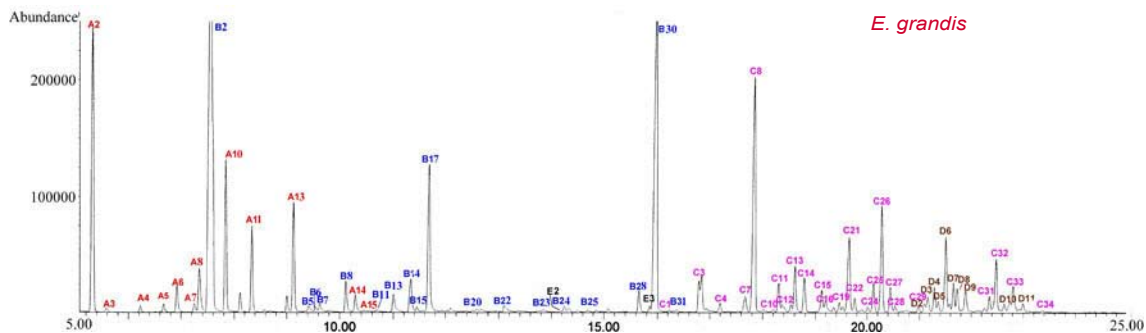
12. 墨點櫻桃葉精油(採集地：林業試驗所蓮華池分所)

Peak no.	Constituents	K.I.	Concentration (%)
1	benzaldehyde	960	73.3
2	1,8-cineole	1031	5.4
3	α-terpinyl	1189	1.4
4	methyl salicylate	1192	3.3
5	α-terpinyl acetate	1349	4.4
Monoterpene hydrocarbons (%)			1.4
Oxygenated monoterpenes (%)			13.5
Sesquiterpene hydrocarbons (%)			1.2
Oxygenated sesquiterpenes (%)			2.0
Diterpenes (%)			3.0
Others (%)			79.0
Oil Yield (ml/100 g)			0.90±0.03

13. 垂尾桉葉精油(採集地：林業試驗所古坑造林地)



14. 玫瑰桉葉精油(採集地：林業試驗所古坑造林地)



13. 垂尾桉葉精油(採集地：林業試驗所古坑造林地)

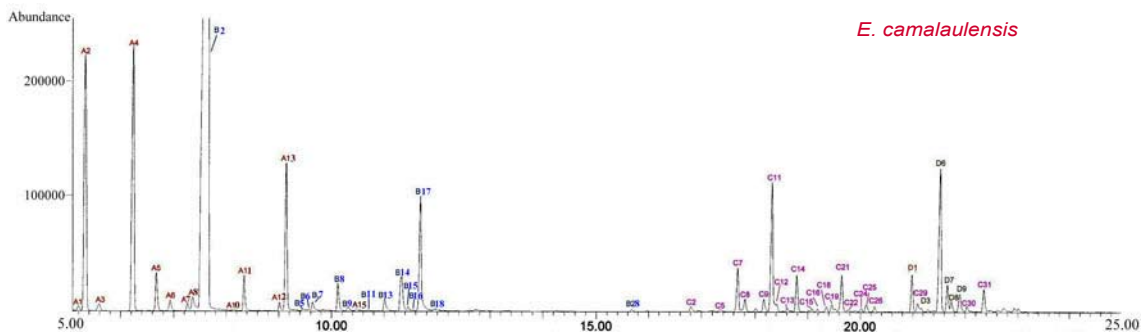
Peak no.	Constituents	K.I.	Concentration (%)
A2	$\alpha$ -pinene	939	2.3
A8	p-cymene	1025	17.63
B2	1,8-cineole	1034	12.15
A10	trans-ocimene	1052	3.06
A11	$\gamma$ -terpinene	1060	26.39
B14	4-terpineol	1177	4.93
B30	$\alpha$ -terpinene acetate	1339	3.37
Monoterpene hydrocarbons			55.72
Oxygenated monoterpenes			29.49
Sesquiterpene hydrocarbons			3.84
Oxygenated sesquiterpenes			8.74
Oil Yield (ml/100 g, v/dry wt)			3.14

14. 玫瑰桉葉精油(採集地：林業試驗所古坑造林地)

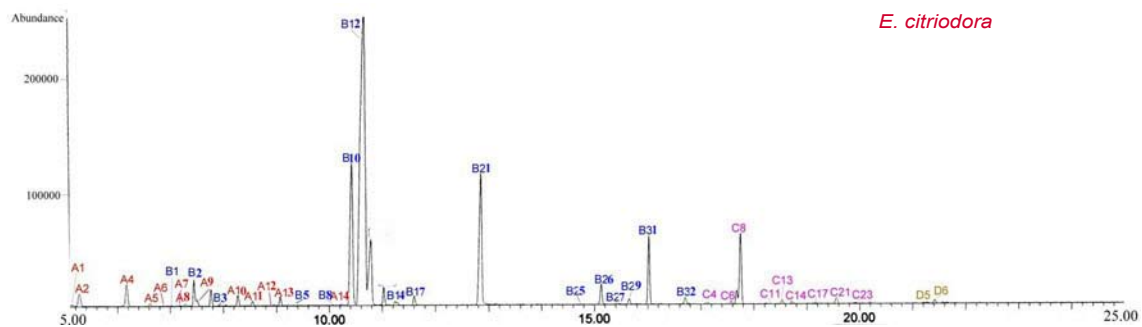
Peak no.	Constituents	K.I.	Concentration (%)
A2	$\alpha$ -pinene	939	7.6
B2	1,8-cineole	1034	19.2
A10	trans-ocimene	1052	4.0
A11	$\gamma$ -terpinene	1060	2.0
A13	terpinolene	1089	2.7
B17	$\alpha$ -terpineol	1189	5.0
B30	$\alpha$ -terpinene acetate	1339	12.1
C8	caryophyllene	1419	7.4
C28	$\delta$ -cadinenes	1590	2.2
Monoterpene hydrocarbons			24.1
Oxygenated monoterpenes			45.5
Sesquiterpene hydrocarbons			19.1
Oxygenated sesquiterpenes			10.5
Oil Yield (ml/100 g, v/dry wt)			3.0



15. 赤桉葉精油(採集地：林業試驗所古坑造林地)



16. 檸檬桉葉精油(採集地：林業試驗所古坑造林地)



15. 赤桉葉精油(採集地：林業試驗所古坑造林地)

Peak no.	Constituents	K.I.	Concentration (%)
A2	$\alpha$ -pinene	939	8.16
A4	$\beta$ -pinene	979	8.2
B2	1,8-cineole	1034	44.68
A13	terpinolene	1089	3.82
B17	$\alpha$ -terpineol	1189	3.35
C11	aromadendrene	1432	3.68
D8	(-)-globulol	1585	4.34
Monoterpene hydrocarbons			40.51
Oxygenated monoterpenes			38.2
Sesquiterpene hydrocarbons			8.76
Oxygenated sesquiterpenes			10.06
Oil Yield (ml/100 g, v/dry wt)			3.48

16. 檸檬桉葉精油(採集地：林業試驗所古坑造林地)

Peak no.	Constituents	K.I.	Concentration (%)
B10	isopulegol	1146	19.08
B12	citronellal	1150	42.23
B21	citronellol	1220	10.11
B31	neryl acetate	1362	3.03
C8	caryophyllene	1419	4.23
Monoterpene hydrocarbons			8.23
Oxygenated monoterpenes			81.91
Sesquiterpene hydrocarbons			7.77
Oxygenated sesquiterpenes			0.41
Oil Yield (ml/100 g, v/dry wt)			1.89