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Chemical constituents of the volatile oil of *Laggera pterodonta*

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Abstract: The essential oil from the aerial parts of *Laggera pterodonta* was extracted by hydrodistillation and analyzed by a combination of gas chromatography – flame ionization detector (GC-FID) and gas chromatography – mass spectrometry (GC-MS). The essential oil was obtained in 0.025% yield as a light yellow liquid. The major constituents of the volatile oil of *Laggera pterodonta* were thymohydroquinone dimethyl ether (21.3%), cubenol (15.2%), caryophyllene (6.8%), α -humulene (5.5%), and chrysanthenone (3.5%). In addition, the volatile oil inhibited some plant pathogenic fungi such as *Lasiodiplodia theobromae* and *Tricoderma resei* and human pathogenic bacteria such as *Micrococcus luteus*, MRSA OB10 and *Staphylococcus epidermidis* using agar diffusion technique.

Introduction

Laggera pterodonta (DC.) Sch. Bip. Ex Oliv. or *Laggera pterodonta* (DC.) Benth. is a weed, widely distributed from southwestern China to northern Thailand, especially in Chiang Mai and Chiang Rai provinces. The plant, commonly known as “Naad Leium or Naad Doi” in Thai, belongs to the family Asteraceae and has been used as traditional medicine by the natives for the treatment of a variety of conditions [1]. Pharmacological research revealed that extract of *L. pterodonta* has antibacterial, anti-inflammatory, anti-malarial and anti-leukaemia activities [2,3]. Several studies on the chemical constitutions of the crude extract from *L. pterodonta* have been reported [1-7], but the components and biological activities of *L. pterodonta* essential oil have not been studied previously. We report here the results of the identification of *L. pterodonta* essential oil components using a combination technique of GC-FID and GC-MS as well as its antifungal and antibacterial activity.

Materials and Methods

Materials: Fresh aerial parts of *L. pterodonta* were collected from Mae Rim, Chiang Mai, Thailand in March 2005. A voucher specimen number 25100 was deposited at CMU herbarium, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand.

Extraction of Essential Oil: Fresh plant material (10 kg) was chopped into small pieces and subjected to hydrodistillation for 6 h, using a modified Clevenger-type apparatus to yield 2.5 mL of light yellow oil. The obtained essential oil was then dried over anhydrous sodium sulphate.

Analysis of Essential Oil. A chemical composition in the essential oil was analysed by a combination of GC-FID and GC-MS techniques.

GC-FID analysis was carried out using a Varian 3700 gas chromatograph coupled to a Shimadzu C-R3A integrator. Separation was achieved using H₂ as carrier gas (ca. 1 mL/min) with a fused silica capillary column (25QC/BP5) obtained from SGE, Australia (25 m $\times$ 0.25 mm i.d., 0.25 μ m film thickness). The capillary column was connected to a Z guard column (2 m) of deactivated fused silica supplied by Phenomenex. Injector and detector temperatures were 260°C and 280°C, respectively; oven temperature programme, 2 min isothermal at 40°C, then at 4°C/min to 280°C (10 min isothermal).

GC-MS analysis was performed in electron impact mode (EI, 70 eV) with a Shimadzu QP5050A system, using the same temperature programme, with He as the carrier gas (1 mL/min) and a capillary column (BP-5) supplied by SGE, Australia (30 m $\times$ 0.32 mm i.d., 0.25 μ m film thickness). For each analysis, programmed-temperature Kováts retention indices (RI) were obtained by analysis of the oil spiked with an *n*-alkane mixture containing each homologue from *n*-C₈ to *n*-C₁₀.

Antifungal and Antibacterial Assay: A preliminary bioassay on antifungal activity and antibacterial activity of the essential oil of *L. pterodonta* was performed by agar diffusion technique [8]. Tested plant pathogenic fungi and human pathogenic bacteria were *Lasiodiplodia theobromae* and *Tricoderma resei*, and *Micrococcus luteus*, Methicillin resistant *Staphylococcus aureus* OB10 (MRSA OB10) and *Staphylococcus epidermidis*, respectively.

Results and Discussion

Identification of the oil components was performed by a comparison of mass spectra with literature data (NIST, NISTREP) and by comparison of their retention indices (RI) with those reported in the literature [9]. Table 1 lists the identified compounds in the order of their elution on capillary column used for GC-FID analysis. A typical gas chromatogram of the essential oil from *L. pterodonta* is presented in Figure 1. The most prominent compounds found were thymohydroquinone dimethyl ether (21.3%), cubenol (15.2%), caryophyllene (6.8%), α -humulene (5.5%), and chrysanthenone (3.5%), respectively, with integrator raw peak areas expressed as a percentage of the total chromatographable components of the essential oil. These compounds accounted for

approximately 84.1% of total essential oil components. A number of components could not be identified due to the lack of reference spectra and/or their relatively low abundance.

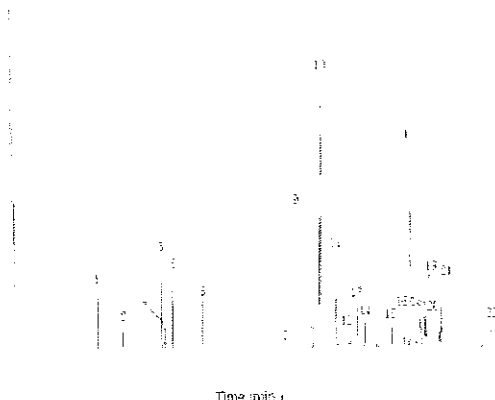


Figure 1. Gas chromatogram of the essential oil of *L. pterodonta*. See experimental for GC condition and Table 1 for peak identifications.

Table 1: Chemical compositions of the essential oil of *L. pterodonta*.

No.	Compounds	RA ^a (%)	RI ^b (Exp)	RI ^c (Lit)	MW	Identification ^d
1	Sabinene	2.30	966	976 ¹	136	1,2
2	<i>p</i> -Cymene	1.17	1010	1026 ¹	134	1,2
3	Undenified	4.60	1097			
4	Eucaryone	1.39	1104		150	1,2
5	Chrysanthemone	3.12	1116	1123 ¹	150	1,2
6	Terpinen-4-ol	2.70	1176		154	2
7	α -Longipinene	0.47	1338	1351 ¹	204	1,2
8	β -elemene	0.59	1393	1391 ¹	204	1,2
9	(Z)- γ -Caryophyllene	6.78	1409	1404 ¹	204	1,2
10	Thymohydroquinone dimethyl ether	21.28	1413		194	2
11	α -Humulene	5.48	1444	1454 ¹	204	1,2
12	Germaacrene D	0.66	1476	1480 ¹	204	1,2
13	2-isopropenyl-4,4,7a-trimethyl-2,4,5,6,7,7a-hexahydrobenzofuran-6-ol	2.59	1492		222	2
14	δ -Cadinene	1.80	1509	1524 ¹	204	1,2
15	Caryophyllene oxide	1.47	1569	1581 ¹	220	1,2
16	γ -Eudesmol	1.03	1613	1630 ¹	222	1,2
17	Cubenol	15.17	1633	1642 ¹	222	1,2
18	Aristolene	2.91	1630		204	2
19	α -Cadinol	1.37	1643		222	1,2
20	Eudesma-3,7(11)-diene	2.75	1647	1653 ¹	222	2
21	Eudesma-7(11)-en-4-ol	1.24	1686		222	2
22	Undenified	2.41	1818			

^a RA: Relative area (raw peak area relative to total peak area)

^b RI (exp): Programmed temperature retention indices as determined on BP-5 column using a homologous series of *n*-alkanes (C₇-C₃₅) as internal standard and H₂ as carrier gas.

^c RI (lit): Value from literature data using He as carrier gas. T: Programmed temperature values. MW: Molecular weight

^d 1: Based on retention index; 2: Based on comparison of mass spectra with literature data (NIST, NISTREP)

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