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Composition of Essential Oils from *Litsea acutivena* Hayata

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Abstract

The chemical components of the leaf oil of *Litsea acutivena* Hayata collected from Pù Huống Natural Reserve, Nghệ An Province, Vietnam, were identified by co-chromatography with authentic samples, gas chromatography/mass spectrometry (GC/MS) and linear retention indices. The significant compounds of *L. acutivena* were *α*-phellandrene (30.4%) and *α*-pinene (14.2%). The constituents of essential oil of *L. acutivena* from Vietnam are being reported for the first time.

Keywords

Litsea acutivena, Essential Oil, Terpenes

1. Introduction

The volatile compositions of some Vietnamese species of *Litsea* have reported recently. In our previous report [1], we have identified limonene (17.5%), *β*-caryophyllene (14.2%), bicyclogermacrene (13.1%), bicycloelemene (12.4%) and *α*-phellandrene (8.0%) as the major constituents of the leaf oil of *L. helferi*. Likewise, the oil of *L. ferruginea* contained large amounts of sabinene (34.5%), *α*-pinene (10.1%), *γ*-terpinene (7.8%), limonene (6.9%) and terpinen-4-ol (6.6 %) while linalool (23.4%), *α*-pinene (26.1%) and *β*-pinene (11.7%) were the compounds occurring in large proportions in the leaf oil of *L. verticillata*. Moreover, (*E*)-*β*-ocimene (57.4%), was the significant compound in the leaf oil of *L. glutinosa*. In addition, (*Z*)-citral (32.9% - 66.1%), sabinene (1.4% - 14.2%), limonene (7.0% - 13.6%) and linalool (1.9% - 9.5%) were the main compounds

in the leaf, stem, fruits and roots oils of *L. cubeba* [1].

Phytochemical studies on *L. acutivena* revealed the characterization of dehydroxymethylailanthoidol, litseakolide D-G [2], acutilactone [3] and 4-nonacosyldihydrofuran-2-one [3]. In a previous report [4], the main volatile compounds of the leaf oil of *L. acutivena* were found to be *γ*-patchoulene (11.0%), *δ*-cadinene (6.3%), *trans*-muurola-3,5-diene (5.9%) and *β*-selinene (5.3%). However, the components occurring in higher quantity from the twig oil were characterised to be *τ*-cadinol (13.1%), *β*-selinene (9.6%), *trans*-*β*-ocimene (6.2%) and *α*-cadinol (7.7%).

In continuation of our extensive research on the analysis of essential oils from Vietnamese flora [1] [5] [6], this paper reports the volatile constituents of *L. acutivena* leaf oil.

2. Materials and Methods

2.1. Plants Collection

The leaves of *L. acutivena* were collected from Pù Huống Natural Reserve, Nghệ An Province (19˚20'N 104˚50'E), Vietnam, in August 2014. Botanical identification was achieved by Dr. Nguyen Lam. A voucher specimen NTL384 was deposited at the Botany Museum, Vinh University, Vietnam.

2.2. Preparation of Plant Sample

Prior to hydrodisitillation, the leaves of *L. acutivena* were air-dried (17˚C, without washing with water) under laboratory shade for two weeks to reduce the moisture contents. In addition, sediments and other unwanted materials were separated from the samples. Afterwards, samples were pulverized to coarse powder using a locally made grinder.

2.3. Hydrodistillation of Essential Oil

A total of 500 g of the pulverized plant samples were used for the experiment at different time. Known weight of samples was separately and carefully introduced into a 5 L flask and distilled water was added until it covers the sample completely. Essential oils were obtained by hydrodistillation which was carried out in an all glass Clevenger-type distillation unit designed according to Vietnamese Pharmacopoeia [7] as described previously [1] [5] [6]. All experiments were done in triplicate. The distillation time was 3 h and conducted at normal pressure. The volatile oils distilled over water and were collected by running through the tap in the receiver arm of the apparatus into clean and previously weighed sample bottles. The oils were kept under refrigeration (4˚C) until the moment of analyses as described previously [1] [5] [6].

2.4. Analysis of Essential Oil

The gas chromatography (GC) analysis of the essential oil was actualised using an Agilent Technologies HP 6890 Plus Gas chromatograph containing Flame

Ionization Detector, fused with HP-5MS column (dimensions: 30 m × 0.25 mm; film thickness 0.25 μm). He (1 mL/min) was used as carrier gas. The inlet pressure was 6.1 kPa. The injector and detector temperatures were maintained at 250˚C and 260˚C respectively. The analysis was done by column temperature programmed starting from 40˚C (2 min hold) and ending at 220˚C (10 min hold) at 4˚C/min. The volume of the sample injected was 1.0 μL and injection was done at the split ratio of 10:1. Each analysis was performed in triplicate. The relative amounts of individual components were calculated based on the GC peak area (FID response).

For the experiment on gas-chromatograph-mass spectrometry analysis, a HP 6890N Plus gas chromatograph interfaced with a mass spectrometer HP 5973 MSD was used. The column employed was HP-5 MS (fused capillary, dimension: 30 m × 0.25 mm; film thickness 0.25 μm). The condition for the gas chromatograph was as described above. The conditions used for the Mass Spectrometry were ionization voltage of 70 eV, with mission current 40 mA. The acquisitions scan mass range of 35 - 350 amu at a sampling rate of 1.0 scan/s was maintained throughout the experiment.

2.5. Identification of Constituents of Essential Oil

The identification of constituents from the GC/MS spectra of *L. acutivena* was performed on the basis of retention indices (RI) determined with reference to a homologous series of *n*-alkanes (C_4-C_{40}), under identical experimental conditions. In some cases, co-injection with known compounds or standards (Sigma-Aldrich, St. Louis, MO, USA) under the same GC conditions was employed. The mass spectral (MS) fragmentation patterns were checked with those of other essential oils of known composition (NIST 08 Libraries) [8] and with those in the literature as described previously [1] [5] [6].

3. Results and Discussion

The average yield of the essential oil was 0.16% ± 0.01% (v/w) calculated on a dry weight basis. Both oil samples were light yellow in colouration. All compounds are listed in order of their elution from the HP-5MS column (**Table 1**). From the results presented (**Table 1**) the 22 leaf oil constituents of *L. acutivena* were primarily monoterpenoids. Monoterpene hydrocarbons (62.0%) occurred in higher amounts with quantitative amounts of sesquiterpene hydrocarbons (17.9%) and oxygenated sesquiterpenes (11.3%). Among the monoterpenes, α-phellandrene (30.4%) and *α*-pinene (14.2%) were the major compounds. Previously, sesquiterpene compound predominated in the the leaf of *L. acutivena* from Taiwan [4]. Conversely, com pounds such as *γ*-patchoulene and *trans*-muurola-3,5-diene described from Taiwanese oil were not identified in the Vietnamese sample. In addition, the quantity of *α*-phellandrene and *α*-pinene in the Taiwanese oils [4] are lower when compared with data obtained in the present study.

Table 1. Compounds identified in the essential oil of *L. acutivena*.

Sr. No.	Compounds[a]	RI[b]	RI[c]	Percent composition[d]
1	*α*-Pinene	939	932	14.2
2	*β*-Pinene	980	978	7.3
3	Myrcene	990	988	1.2
4	a-Phellandrene	1006	1004	30.4
5	*p*-Cymene	1024	1020	3.4
6	*β*-phellandrene	1028	1026	1.8
7	Limonene	1032	1030	1.7
8	(*Z*)-*β*-Ocimene	1043	1034	1.1
9	*γ*-Terpinene	1061	1056	0.9
10	Linalool	1100	1100	4.8
11	(*Z*)-Citral	1318	1318	1.1
12	b-Caryophyllene	1419	1417	3.8
13	Aromadendrene	1440	1439	1.2
14	*allo*-Aromadendrene oxide	1456	1458	0.9
15	a-Patchoulene	1457	1460	2.4
16	Guaia-1(10),11-diene	1490	1490	5.7
17	(*E*,*E*)-*α*-Farnesene	1508	1505	4.8
18	Ledol	1569	1570	1.4
19	*α*-Guaiol	1600	1600	1.5
20	*β*-Acorenol	1637	1640	1.7
21	7(11)-Selinen-4*α*-ol	1693	1694	4.1
22	Zerumbone	1756	1760	1.7
	Total			**97.1**
	Monoterpene hydrocarbons (Sr. No. 1 - 9)			**62**
	Oxygenated monoterpenes (Sr. No. 10 and 11)			**5.9**
	Sesquiterpene hydrocarbons (Sr. No. 12 - 17)			**17.9**
	Oxygenated sesquiterpenes (Sr. No. 18 - 22)			**11.3**

[a]Elution order on HP-5MS column; [b]Retention indices on HP-5MS column; [c]Literature retention indices (NIST, 2011); [d]Standard deviation (SD±) were insignificant and were excluded from the Table; Sr. No. serial Number.

Monoterpene compounds were the main classes of compounds occurring in higher quantity in Vietnamese oil sample as against the sesquiterpenoids found in Taiwnaese oil [4]. These results demonstrate significant regional variation in the chemical composition of *L. acutivena*.

The chemical composition of essential oils of *Litsea* plants can be classified according to class of compounds they contained. Recent information showed

that the compositions of the oils of *L. ferruginea*, *L. verticillata*, *L. cubeba* and *L. glutinosa* [1] were dominated by monoterpene compounds like the oils of *L. acutivena* in the present study. The monoterpenes neral and geranial [9] and *γ*-terpinene [10] were the main constituents of essential oils of *L. cubeba* from China and several other parts of the world [1]. Likewise the monoterpene 1,8-cineole was present in *L. pungens* [10] while *L. akoensis* leaf oil limonene, thymol and *p*-cymene with *β*-phellandrene and *trans*-*β*-ocimene present in the twig oil [11]. It could be seen that the main monoterpene components of the individual species differed from each other. The leaf oils of *L. helferi* had abundance of sesquiterpene compounds including *β*-caryophyllene, bicyclogermacrene and bicycloelemene [1] while *γ*-patchoulene, *δ*-cadinene and *trans*-muurola-3,5-diene occurred in higher amounts in *L. acutivena* [4]. The main sesquiterpene compounds identified in *L. glutinosa* [12] were *β*-caryophyllene and bicyclogermacrene with *α*-humulene and *δ*-cadinene making up the major components of *L. nakaii* [13]. Previously the sesquiterpenes *β*-eudesmol, *γ*-eudesmol and *δ*-selinene were identified in *L. kostermansii* [14] while *L. acuminata* [15] contained *β*-caryophyllene, *τ*-cadinol, *α*-cadinol and *α*-humulene. The main components of the leaf oil of *L. linii* were *β*-eudesmol, *τ*-cadinol and *α*-humulene [16]. However, *L. mushaensis* leaf oil contained higher amounts of *β*-selinene, *α*-selinene and *β*-caryophyllene [16]. As usual, the identities of the major sesquiterpene components of the individual species differed from one another. Also, mixture of monoterpene and sesquiterpene compounds (*trans*-*β*-ocimene and *β*-selinene) characterized the essential oil of the twig of *L. mushaensis* [16]. The compositions of essential oil of *L. coreana* leaf was domainted mainly by mixture of sesquiterpene compounds and fatty acids namely n-decanal, (2*E*, 6*E*)-farnesol, *β*-eudesmol and ethyl n-dodecanoate [17]. It can be postulated that both intra and inter species variation could be observed in the essential oils of *Litsea* plants.

4. Conclusion

The paper reported the compounds identified in the essential oils of *L. acutivena* grown in Vietnam. The significant compounds of the oil were *α*-phellandrene and *α*-pinene. In addition, a comparative analysis of the composition of the essential oils was performed with results from the same species reported elsewhere and other species reported from Vietnam as well as *Litsea* plants grown in other parts of the world. The results indicated differing compositional pattern with the same species and other species.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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