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Chemical constituents of the essential oil from the bark of *Cinnamomum illicioides* A. Chev. from Vietnam

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Abstract The chemical constituents of the hydrodistilled essential oil from the bark of *Cinnamomum illicioides* A. Chev., Lauraceae, from Vietnam, have been studied by GC and GC–MS. Seventeen monoterpenoids, eugenol, and thirty-six sesquiterpenoids, accounting for 25, 41.2, and 27.9% of the oil, respectively, were identified. Terpinen-4-ol (10.4%), eugenol (41.2%), and δ-cadinene (5.6%) are the major components of the oil.

Keywords *Cinnamomum illicioides* · Lauraceae · Eugenol · Terpinen-4-ol · δ-Cadinene · GC · GC–MS

Introduction

The tree *Cinnamomum illicioides* A. Chev. (Lauraceae), commonly known in Vietnam as Gu huong, is up to 30 m tall and 1–1.5 m in diameter. The plant grows in forested valleys or in dense forest approximately 800 m above sea level in Hainan, Guangxi (China), and Northern Vietnam. *Cinnamomum camphora*, *C. balansae*, *C. burmannii*, *C. aromaticum*, *C. cassia*, *C. caryophyllus*, *C. iners*, *C. loureirii*, *C. obtusifolium*, *C. parthenoxylon*, *C. simmondii*, *C. tetragonum*, and *C. zeylanicum*, which are known to produce essential oils, are used in Vietnamese traditional medicine [1]. The odor of *C. illicioides* is reported to be similar to that of *C. camphora* L. Nees. et Eberm. (syn. *Laurus camphora* L.); the tree is, therefore, a very interesting target for research. Although investigation of the chemical constituents of other *Cinnamomum* species, for example *C. cassia*, *C. zeylanicum*, or *C. osmophloeum*, and correlation of these with their antibacterial and antifungal activity has been extensively undertaken [2–4], there is no report of the chemical constituents of *C. illicioides* essential oil. Our study revealed that hydrodistillation of the dried bark of *C. illicioides* furnished a large amount of essential oil (1.36% yield based on the dry material). Chemical study of this essential oil has revealed the presence of constituents which, by correlation with those of previously investigated *Cinnamomum* oils, will help us to examine the economic value of the oil as a natural flavoring and/or antibacterial and antifungal agent. This paper reports the analysis of the chemical constituents of the essential oil from the dried bark of *C. illicioides*.

Results and discussion

Fifty-four components of the essential oil from the dried bark of *C. illicioides*, representing 94.1% of the oil, were identified in this study. Seventeen monoterpenoids, eugenol, and thirty-six sesquiterpenoids accounting for 25, 41.2, and 27.9% of the oil, respectively, are listed in Table 1. The oil is rich in eugenol (41.2%) and terpinen-4-ol (10.4%), which can be used as chemical markers of the oil. δ-Cadinene (5.6%), α-copaene (4.1%), (*E*)-β-caryophyllene (3.0%), and α-cadinol (1.6%) are the most abundant sesquiterpenoid components. A gas chromatogram obtained from the essential oil is shown in Fig. 1. Previous studies classified two samples of *C. cassia* and *C. zeylanicum* bark oils from Taiwan into cinnamaldehyde–coumarin [2] and cinnamaldehyde–eugenol types [3], respectively, on the basis of the main constituents

W.A. König passed away on 19 November 2004.

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Table 1 Constituents of the essential oil from the dried bark of *Cinnamomum illicioides*

No.[a]	Compound	Content (%)[b]
1	α-Thujene	0.1
2	α-Pinene	1.9
3	Camphene	0.5
4	*β*-Pinene	0.9
5	Myrcene	0.3
6	α-Terpinene	0.4
7	*p*-Cymene	1.1
8	1,8-Cineol	2.6
9	*γ*-Terpinene	0.5
10	Terpinolene	0.2
11	*cis*-*p*-Menthen-2-en-1-ol	tr.[c]
12	Pinocarvone	0.1
13	Borneol	2.7
14	Terpinen-4-ol	10.4
15	α-Terpineol	3.3
16	Bornyl acetate	tr.
17	Carvacrol	tr.
18	Eugenol	41.2
19	α-Cubebene	1.4
20	α-Copaene	4.1
21	*β*-Elemene	0.5
22	*cis*-α-Bergamotene	tr.
23	(*E*)-*β*-Caryophyllene	3.0
24	*trans*-α-Bergamotene	tr.
25	Guaia-6,9-diene	0.2
26	Aromadendrene	tr.
27	4α*H*,10α*H*-Guaia-1(5),6-diene	0.2
28	α-Humulene	0.8
29	*allo*-Aromadendrene	0.2
30	7α*H*,10*βH*-Cadina-1(6),4-diene	0.8
31	5-*epi*-Aristolochene	0.3
32	*β*-Neoclovene	0.1
33	*γ*-Humulene	0.2
34	Eremophyla-1(10),7-diene	0.3
35	α-Muurolene	0.7
36	(*E*,*E*)-α-Farnesene	0.1
37	*γ*-Cadinene	0.4
38	Calamenene	0.8
39	*δ*-Cadinene	5.6
40	Zonarene	tr.
41	Cadina-1,4-diene	0.6
42	α-Calacorene	0.2
43	Elemol	0.2
44	Spathulenol	0.3
45	Globulol	0.2
46	α-Guaiol	1.1
47	1-*epi*-Cubenol	1.2
48	T-Muurolol	1.0
49	Amorph-4-en-7-ol	1.0
50	α-Cadinol	1.6
51	Eudesm-4(15)-en-7-ol	tr.
52	7-*epi*-α-Eudesmol	tr.
53	Bulnesol	0.7
54	Cadalene	0.1

[a]Numbering refers to Fig. 1
[b]Relative percentages of components were calculated using the GC CPSil-5-CB column
[c]Trace constituent (≤ 0.05%)

of the oils. The bark oil of *C. illicioides* from Vietnam could therefore be classified as the eugenol–terpinen-4-ol type.

Experimental

Plant material and oil preparation

The dried bark of *C. illicioides* A. Chev. (Lauraceae) was collected in Province Thai Nguyen, Vietnam. The plant was identified by Dr Nguyen Hoanh Coi, a botanical taxonomist of the Military Institute of Pharmaceutical Research and Control, Hanoi, Vietnam, in September 2001, and a voucher specimen (HCTN CI 9-01) is deposited in the Laboratory of Chemistry of Natural Products, Faculty of Chemistry, Vietnam National University, Hanoi, Vietnam. The bark was ground to powder and hydrodistillation of the material for 8 h produced an oil in 1.36% yield.

Gas chromatography (GC)

An Orion Micromat 412 instrument equipped with two fused-silica capillary columns (25 m×0.25 mm i.d., film thickness 0.15 μm), coated with CPSil-5-CB and CPSil-19-CB, split injection, and flame ionization detection, was used. Injector and detector temperatures were at 200 and 250°C. The oven temperature was programmed from 50 to 230°C at 3° min^{-1}. The carrier gas was H_2 at 1.2 mL min^{-1}.

Gas chromatography–mass spectrometry (GC–MS)

A Hewlett–Packard HP 5890 gas chromatograph coupled to a VG Analytical 70-250S mass spectrometer was used. The GC was fitted with a fused-silica capillary column coated with CPSil-5-CB (25 m×0.25 mm i.d., film thickness 0.15 μm). The GC operating conditions were identical with those described above except that helium was used as carrier gas. The MS operating conditions were: ionization potential 70 eV and ion source temperature 230°C.

Identification of the components

The oil was analyzed by dual GC on a non-polar CPSil-5-CB capillary column and on a more polar CPSil-19-CB capillary column of identical dimensions. GC–MS was performed with a CPSil-5-CB column. Compounds were identified by comparison of retention indices and mass spectra with those of authentic samples, obtained under identical experimental conditions, and use of a computer-supported spectral library (MassFinder 2.3) [5, 6].

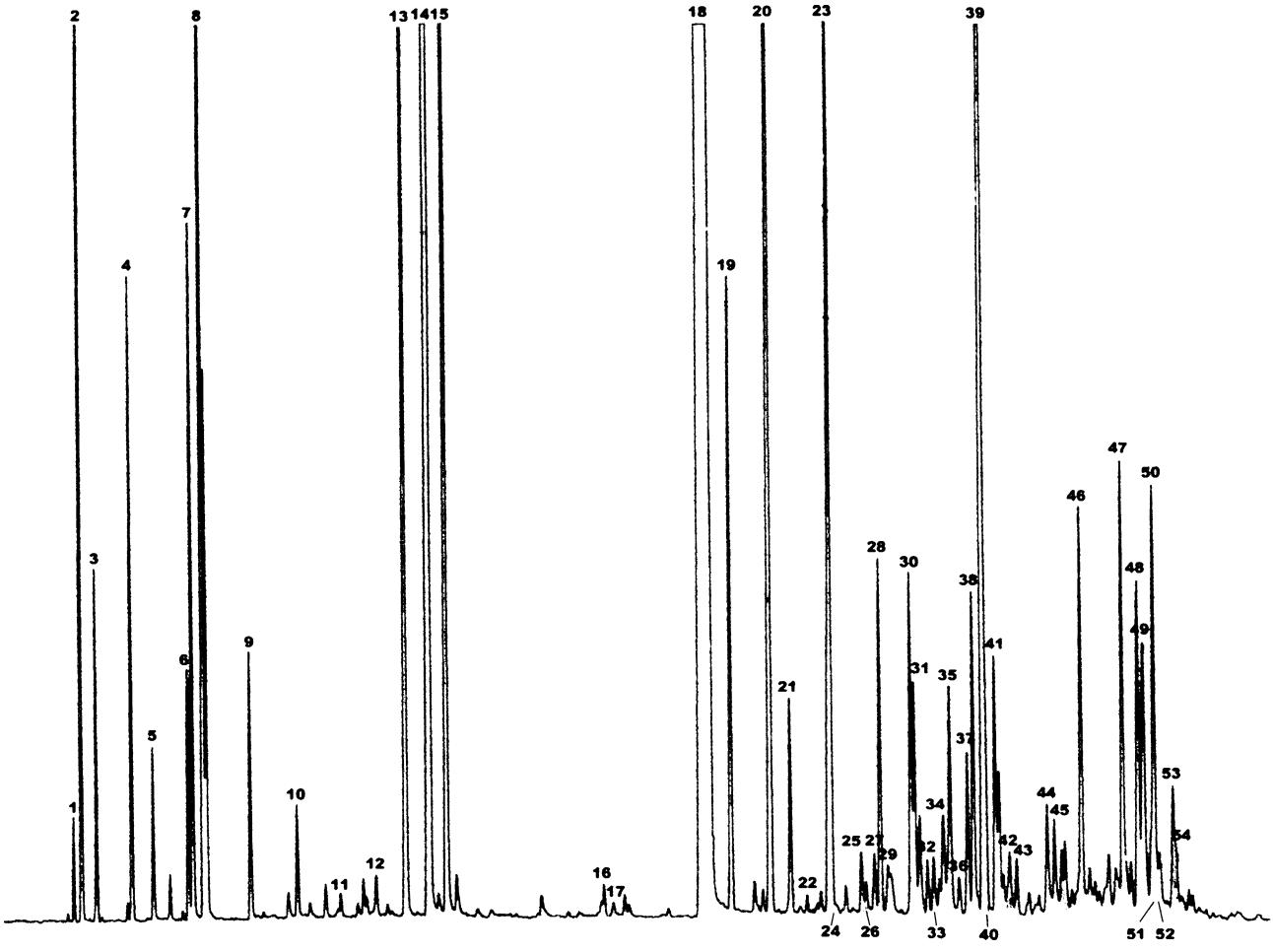

Fig. 1 Gas chromatogram obtained from the essential oil of *Cinnamomum illicioides* of Vietnam

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