DOI 10.1007/s10600-015-1525-z
Chemistry of Natural Compounds, Vol. 51, No. 6, November, 2015

CONSTITUENTS OF ESSENTIAL OILS FROM *Amomum longiligulare* FROM VIETNAM

Le T. M. Chau,[1] Tran D. Thang,[1*] Le T. Huong,[2] and Isiaka A. Ogunwande[3*]

The genus *Amomum* (family Zingiberacea) has over 90 species distributed in Africa, tropical Asia, Australia, and the Pacific Islands. *Amomum longiligulare* T. L. Wu is a precious medicinal plant. It is known in Vietnam by names such as Sa Nhan Tim. It is a plant that grows up to 1–1.5 m tall with glabrous petiole and lanceolate leaf [1]. The fruit is used as a spice ingredient in Vietnam, China, and Taiwan. In Vietnam, Sa Nhan Tim is used in treating indigestion, abdominal burn cold, due to cold, diarrhea, vomiting, threatened abortion, dysentery, toothache, and edema [2]. In Chinese herbal medicine, it is regarded as a stomachic and used to counteract cold [3]. Literature reports are scanty on the analysis of the chemical and pharmacological effects of this plant. A previous study indicated that the plant possessed antioxidant activity [4]. This prompted our interest in the analysis of the chemical constituents of the oils from the leaves, stems, and roots of the plant (Table 1). The major constituents of previously described oils from the seeds were β-pinene [5], camphor, borneol acetate, and D-limonene [6–8]. The essential oil was shown to exhibit antibacterial properties [7]. The non-volatile substances isolated from this plant include saponins [9] and glycosides such as amomumoside, ((+)-angelicoidenol-2-*O*-β-D-glucopyranoside), quercitrin (quercetin-3-*O*-α-L-rhamnopyranoside), epicatechin [10], vitamins, and microminerals [11]. We have recently published data on essential oils from Vietnamese plants [12].

Samples of *A. longiligulare* (DND 279) were collected from Pu Huong Nature Reserve, Nghean Province, Vietnam, in August 2011. The air-dried samples (500 g each) were hydrodistilled in a Clevenger-type apparatus [13] for 3 h to afford oils with yields of 0.25%, 0.20%, and 0.20% (v/w), respectively, for the leaves, stems, and roots (oils were yellowish in color), calculated on a dry weight basis.

GC analysis was performed on an Agilent Technologies HP 6890 Plus gas chromatograph equipped with a FID and fitted with HP-Wax and HP-5MS columns (both 30 m × 0.25 mm, film thickness 0.25 μm, Agilent Technologies). The analytical conditions were: carrier gas H_2 (1.0 mL min^{-1}), injector temperature (PTV) 250°C, detector temperature 260°C, column temperature programmed 60°C (2 min hold) to 220°C (10 min hold) at 4°C min^{-1}, split ratio 10:1, and volume injected 1.0 μL.

An Agilent Technologies HP 6890N Plus chromatograph fitted with a fused silica capillary HP-5 MS column and interfaced with an HP 5973 MSD mass spectrometer (70 eV) was used for the GC/MS analysis, under the same conditions as above. Compound identification was performed by comparison of their retention indices (RI) and MS data with literature data [14, 15].

A total of 46, 45, and 39 compounds, respectively, were identified in the leaves, stems, and roots oils of the plant. This accounted for 99.6%, 99.6%, and 99.4% of the total oil contents, respectively. The leaf comprised mainly of β-caryophyllene (26.6%), α-pinene (15.6%), humulene epoxide II (14.8%), and α-humulene (12.5%). The major compounds in the stem were β-caryophyllene (37.4%), α-humulene (16.5%), and hexahydrofarnesyl acetone (10.0%). However, camphene (15.7%), hexadecanoic acid (10.0%), octadecanoic acid (8.6%), and bornyl acetate (7.8%) were the main constituents of the root oil. All the major compounds of *A. longiligulare* in this study, such as α-pinene, camphene, β-caryophyllene, α-humulene, hexahydrofarnesyl acetone, and octadecanoic acid, were not identified in previous studies [5–8]. Camphor, as previously reported [6–8], was not identified in the present oil samples, which also possessed low β-pinene contents.

1) Faculty of Chemistry, Vinh University, 182-Le Duan, Vinh City, Nghe An Province, Vietnam, e-mail: thangtd@vinhuni.edu.vn; 2) Faculty of Biology, Vinh University, 182-Le Duan, Vinh, Vietnam, e-mail: didn23@gmail.com; 3) Natural Products Research Unit, Department of Chemistry, Faculty of Science, Lagos State University, Badagry Expressway Ojo, P. M. B. 0001, LASU Post Office, Ojo, Lagos, Nigeria, e-mail: isiaka.ogunwande@lasu.edu.ng. Published in *Khimiya Prirodnykh Soedinenii*, No. 6, November–December, 2015, pp. 1015–1016. Original article submitted December 31, 2013.

TABLE 1. Constituents of the Oils from the Leaves, Stems, and Roots of *Amomum longiligulare*, %

Compound	RI*	Leaves	Stems	Roots	Compound	RI*	Leaves	Stems	Roots
Tricyclene	926	–	–	0.6	α-Humulene	1452	12.5	16.5	1.4
α-Pinene	939	15.6	5.4	4.6	Selina-4(15),6-diene	1455	0.2	0.4	2.9
Camphene	953	0.4	0.2	15.7	Dehydroaromadendrene	1463	–	–	1.2
β-Pinene	980	0.3	0.1	–	γ-Muurolene	1480	0.2	–	–
β-Myrcene	990	0.1	0.1	0.3	α-Amorphene	1484	–	0.2	1.5
α-Phellandrene	1006	0.1	0.1	0.1	Germacrene D	1485	–	0.3	1.0
δ-3-Carene	1011	0.5	0.5	0.4	*epi*-Bicyclosesquiphellandrene	1487	0.7	–	1.8
α-Terpinene	1017	0.1	–	0.1	β-Selinene	1489	0.5	0.2	0.3
p-Cymene	1026	0.3	–	–	Valencene	1497	–	–	0.6
Limonene	1032	3.1	3.2	3.2	α-Selinene	1498	0.6	–	–
1,8-Cineole	1034	–	–	0.2	β-Bisabolene	1506	2.9	2.6	–
(*Z*)-β-Ocimene	1043	0.4	0.1	–	*cis*-α-Bisabolene	1511	0.6	1.1	–
(*E*)-β-Ocimene	1052	0.8	0.2	–	γ-Cadinene	1514	–	0.4	–
γ-Terpinene	1061	0.1	0.1	0.4	δ-Cadinene	1522	–	0.5	3.7
α-Terpinolene	1090	0.2	0.1	1.4	*trans*-γ-Bisabolene	1527	0.3	–	3.6
Linalool	1100	0.1	0.3	–	(*E*)-Nerolidol	1563	0.4	0.2	–
endo-Fenchyl acetate	1228	0.1	0.1	4.8	Caryophyllene oxide	1583	2.9	3.4	–
Thymoyl, methyl ether	1235	–	–	0.5	Viridiflorol	1593	0.6	2.7	1.6
Bornyl acetate	1289	0.1	0.2	7.8	Humulene epoxide II	1600	14.8	1.3	–
Bicycloelemene	1337	–	0.3	–	Tetradecanal	1611	0.6	0.5	–
p-Mentha-6,8-dien-2-ol acetate	1339	–	0.1	–	α-Bisabolol	1683	0.7	0.2	–
δ-Elemene	1340	–	–	0.4	(*Z*)-3-Heptadecene	1687	0.6	–	–
α-Cubebene	1351	–	–	0.2	Farnesol**	1718	2.0	0.2	–
Isoledene	1372	–	–	0.5	Hexahydrofarnesyl acetone	1848	0.1	10.0	–
α-Copaene	1377	0.2	0.4	4.1	1,2-Benzenedicarboxylic acid	1917	–	0.5	0.4
β-Patchoulene	1381	–	0.3	–	(*Z,Z*)-9,12-Octadecadienal	1971	0.2	0.1	–
β-Panasinsene	1384	–	–	0.3	Hexadecanoic acid	1960	0.6	0.4	10.0
β-Cubebene	1388	–	–	0.7	Eicosane	2000	0.1	5.0	–
β-Elemene	1391	–	–	0.7	Phytol	2142	1.9	0.7	–
β-Caryophyllene	1419	26.6	37.4	–	Octadecanoic acid	2180	0.1	0.1	8.6
Calarene (=β-Gurjunene)	1429	–	–	1.7	(*Z*)-9-Octadecamide	2398	1.6	1.6	3.3
trans-α-Bergamotene	1435	1.3	1.0	–	(*Z*)-13-Docosenamide	2499	1.8	0.2	0.5
γ-Elemene	1437	–	–	2.1	Total		99.6	99.6	99.4
Aromadendrene	1441	–	–	1.0					

*Retention indices on HP-5 MS capillary column; **correct isomer not identified.

ACKNOWLEDGMENT

The authors wish to thank the NAFOSTED (Vietnam) for the financial support of this study through the Project No. 106-NN.03-2014.23.

REFERENCES

1. D. Wu and K. Larsen, *Zingiberaceae* Lindley, in: *Flora of China* (*Flagellariaceae Through Marantaceae*), Vol. 24, Z. Y. Wu and P. H. Raven (Eds), Science Press/Missouri Botanical Garden Press, Beijing/St. Louis, 2000, p. 102–106.
2. Q. B. Nguyen, *Amomum longiligulare* T. L. Wu, in: *Medicinal and Poisonous Plants. 1. Plant Resources of South-East Asia No. 12 (1),* de L. S. Padua, N. Bunyaprapatsara, R. H. M. J. Lemmens (Eds), PROSEA Foundation, Bogor, 1999, p. 117.
3. T. K. Lim, *Edible Medicinal and Non-Medicinal Plants*, Vol. **5**, Fruits, Springer, The Netherlands, 2013, p. 801–802.
4. D. T. H. Vien, L. N. Tu, and D. T. Thu, *J. Sci. Tech.,* **37**, 33 (2000).

5. T. T. Nguyen, V. T. Nguyen, X. Q. Cao, X. T. Nguyen, and T. Q. Tran, *Tap Chi Duoc Hoc.,* **11**, 10 (2002).
6. S. Shen, Y. Sha, C. Deng, D. Fu, J. Chen, and X. Zhang, *J. Official Anal. Chem. Int.,* **88**, 418 (2005).
7. D. M. Nguyen, V. T. Ngo, T. H. V. Do, and N. T. Le, *Nong Nghiep Cong Nghiep Thuc Pham*., **12**, 466 (1994).
8. National Institute of Materia Medica (NIMM), Selected Medicinal Plants in Vietnam, Vol. 1, Science and Technology Publishing House, Hanoi, 1999, p. 439.
9. T. H. V. Do, K. Hostettman, and V. T. Ngo, *ACGC Chem. Res. Commun.,* **11**, 74 (2000).
10. T. H. V. Do, N. T. Le, D. M. Nguyen, and V. T. Ngo, *Nong Nghiep Cong Nghiep Thuc Pham*., **12**, 464 (1994).
11. D. T. H. Vien and L. N. Tu, *J. Sci. Tech.,* **37**, 12 (2000).
12. D. N. Dai, L. T. Huong, T. D. Thang, and I. A. Ogunwande, *Chem. Nat. Compd.,* **50**, 11 (2014).
13. *Vietnamese Pharmacopoeia*, Medical Publishing House, Hanoi, Vietnam, 1997.
14. R. P. Adams, *Identification of Essential Oil Components by Gas Chromatography/Quadrupole Mass Spectrometry,* 4th Edition, Allured Publishing, Carol Stream, Illinois, 2007.
15. D. Joulain and W. A. Koenig, *The Atlas of Spectral Data of Sesquiterpene Hydrocarbons*, E. B. Verlag, Hamburg, Germany, 1998.