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Biological and Chemical Research, Volume 2015, 157-160 | Science Signpost Publishing

Essential Oil Compositions from Root and Rhizome of *Zingiber niveum* Mood & Theilade from Laos

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Received: January 31, 2015 / Accepted: March 01, 2015 / Published: April 25, 2015

Abstract: The essential oils hydrodistilled from root and rhizome of *Zingiber niveum* Mood & Theilade from Laos were analyzed by GC-MS technique. A total of 28 compounds were identified. Major components of the essential oils from its root were found to be elemicin (60.97%), 3β-24-methylene-9,19-cyclolanostan-3-ol (17.67%) and pentadecane (12.73%), whereas those from its rhizome included elemicin (69.46%), pentadecane (18.85%) and α-pinene (2.56%).

Keywords: *Zingiber niveum*, Zingiberceae, Essential oil

1. Introduction

The genus *Zingiber* is a rhizomatous herb, belonging to the family Zingiberaceae, mostly distributed in the tropics and subtropics, especially in Southeast Asia. Several *Zingiber* species have long been known for their uses as foods, spices and medicines. Plants in genus *Zingiber* are ethnomedically used in the treatment of cough, dysentery, indigestion, stomach ache, head ache, muscle pain and constipation [1-8].

Many *Zingiber* species have been previously studied for their essential oil constituents such as *Z. cassumunar* [9], *Z. officinale* [10-12], *Z. spectabile* [13-14] and *Z. zerumbet* [15]. However, there are no previous reports on chemical constituents of essential oils from roots and rhizomes of *Z. niveum*. The aim of this study was to identify chemical compositions of essential oils present in fresh roots and rhizomes of *Z. niveum* from Laos.

2. Materials and Methods

2.1 Plant Material

Fresh roots and rhizomes of *Z. niveum* were purchased in August 2014 from Laos merchant at Chatuchak market, Bangkok, Thailand. The plant sample was identified by Assist. Prof. Thaya Jenjittikul. The voucher specimen of this plant was deposited at Faculty of Pharmacy, Rangsit University, Thailand.

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2.2 Extraction Procedure

The fresh roots and rhizomes of *Z. niveum* (100 g) were washed with tap water, air dried and then blended into small pieces with the blender. The ground material of the plant was subjected to hydrodistillation using Clevenger apparatus for 3 hr. The oils were collected and stored at 4°C in air-tight containers before analyzed by GC-MS technique.

2.3 GC-MS Analysis

Essential oils were diluted in ethanol (HPLC grade, Merck, Germany) with the oil to ethanol ratio of 1:100 by volume and were analyzed by an Agilent Technologies 7890A GC system-equipped with a 5975C inert XL EI/CI MAD with Triple-Axis Detector. The DB-5 MS (phenyl arylene polymer virtually equivalent to 5% phenyl methylpolysiloxane) capillary column (30 m in length, 0.25 mm i.d., and 0.25 μm in thickness) was used as stationary phase. The carrier gas was Helium with the flow rate of 1 ml/min. One microliter of diluted oil was injected using GC sampler 80 autosampler (split ratio 1:20). The operating condition of GC oven temperature was started at 60°C for 1 min, ramped at the rate of 3°C/min to 240°C and hold for 5 min. The GC injector and GC-MSD interface temperatures were set at 180°C and 290°C, respectively. MS operating parameters were ion source 230°C; electron impact ionization positive mode at 70 eV with scan mass range of 40-650 m/z, scan rate 2.42 amu / second.

2.4 Identification of Oil Components

Essential oil components were identified by comparing their mass fragmentation pattern with Adams Essential Oil Mass Spectral library. The amount of each oil component was determined on the basis of peak area measurement.

Table 1 Essential oil components of roots and rhizomes of *Z. niveum*

Chemical components	KI[a]	Content [%]	
		Root	Rhizome
α-Pinene	939	0.92	2.56
Camphene	954	0.47	1.22
Sabinene	975	-	0.07
β-Pinene	979	1.24	2.30
β-Myrcene	990	0.11	0.23
β-Phellandrene	1002	tr	tr
3-Carene	1011	tr	0.07
O-Cymene	1026	tr	0.05
Limonene	1029	0.13	0.25
β-Ocimene	1050	-	0.03
γ-Terpinene	1059	0.08	0.10
Terpinolene	1088	-	0.05
Linalool	1096	0.12	0.85
Camphor	1146	-	0.05
Borneol	1169	0.25	0.25

Geranial	1267	tr	-
Bornyl acetate	1288	0.08	0.23
Tridecane	1300	0.07	0.05
α-Copaene	1376	0.08	0.09
Caryophyllene	1419	0.41	-
Pentadecane	1500	12.73	18.85
α-Farnesene	1505	0.50	0.41
Elemicin	1557	60.97	69.46
iso-Elemicin	1570	2.23	2.53
Heptadecane	1700	0.21	0.29
3β-24-Methylene-9,19-cyclolanostan-3-ol	-	17.67	-
Butyl 9,12-octadecadienoate	-	0.65	-
9,17-Octadecadienal	-	0.97	-

[a] Kovats index is determined relative to n-alkanes (C6–C24) on a DB-5 MS column; tr< 0.05%; – not detected.

3. Results and Discussion

The hydrodistillates of fresh roots and rhizomes of *Z. niveum* were clear and pale yellow oils with the percent yields of 0.10 and 0.12% v/w, respectively. The chemical constituents of the essential oils, their peak area percentages and Kovats Indices (KIs) are compiled in Table 1, in order of their elution on the DB-5 MS column. Twenty-four compounds, corresponding to 99.89%, were identified in the root oil, while 23 compounds, corresponding to 100%, were identified in the rhizome oil. The root and rhizome oils were very rich in phenylpropanoids (63.20% and 71.99%), comprising mainly elemicin (60.97% and 69.46%).

The experimental results were difference from previously reported. Phenylpropanoids, elemicin, were found to be the main chemical constituents in root and rhizome oil of *Z. niveum* while other *Zingiber* species such as *Z. ottensii*, *Z. spectabile* and *Z. zerumbet* gave oxygenated sesquiterpenes, zerumbone, as the main chemical constituents [14-16]. In addition, elemicin and iso-elemicin together with tridecane, pentadecane, heptadecane, 3β-24-methylene-9,19-cyclolanostan-3-ol, butyl 9,12-octadecadienoate and 9,17-octadecadienal were reported for the first time in *Zingiber* oil.

4. Conclusion

This is the first report on essential oil compositions of roots and rhizomes of *Z. niveum*. The results obtained might be used as additional information for phytochemical and chemotaxonomic studies of the *Zingiber* genus in further.

Acknowledgments

The authors are thankful to Assoc. Prof. Thatree Phadungcharoen, Department of Pharmacognosy, Faculty of Pharmacy, Rangsit University, Thailand for valuable information.

References

[1]. Ajibesin, K.K., Ekpo, B.A., Bala, D.N., Essien, E.E. and Adesanya, S.A., 2008. Ethnobotanical survey of Akwa Ibom State of Nigeria. J Ethnopharmacol. 115, 387-408.

[2]. Kumar, A., Tewari, D.D., and Pande, Y.N., 2003, Ethno-phytotherapeutics among Tharus of Beerpur Semara Forest range of Balrampur District (U.P.).J. Econ. Taxon. Bot. 27, 839-844.

[3]. Padal, S.B., Sandhyasri, B. and Chandrasekhar, P., 2013. Traditional use of Monocotyledon Plants of Arakuvalley Mandalam, Visakhapatnam District, Andhra Pradesh, India. IOSR-JPBS, 6, 12-16.

[4]. Devi, N.B., Singh, P.K. and Das, A.K., 2014. Ethnomedicinal Utilization of Zingiberaceae in the Valley Districts of Manipur. IOSR-JESTFT, 21-23.

[5]. Chuakul, W. and Boonpleng, A., 2003. Ethnomedical uses of Thai Zingiberaceous plant (1). Thai J Phytopharm. 10, 33-39.

[6]. Chuakul, W. and Boonpleng, A., 2004. Survey on medicinal plants in Ubon Ratchatani province (Thailand). Thai J Phytopharm. 11, 33-54.

[7]. Rokaya, M.B., Münzbergová, Z. and Timsina, B., 2010. Ethnobotanical study of medicinal plants from the Humla district of western Nepal. J Ethnopharmacol. 130, 485-504.

[8]. Nuammee, A., Seraypheap, K., Yannawat, S. and Seelanan, T.,2012. Ethnobotany of Hmong at Ban Pang Chang, Pong Subdistrict, Santisuk District, Nan province. Thai J Botany, 4, 177-211.

[9]. Bordoloi, A.K., Sperkova, J. and Leclercq, P.A., 1999. Essential oils of *Zingiber cassumunar* Roxb. from Northeast India. J Essent Oil Res, 11, 441-445.

[10]. Singh, G., Kapoor, I.P.S., Singh, P., Heluani, C.S., Lampasona, M. and Catalan, C.A.N., 2008. Chemistry, antioxidant and antimicrobial investigations on essential oil and oleoresins of *Zingiber officinale*. Food Chem Toxicol. 46, 3295–3302

[11]. Kamaliroosta, Z., Kamaliroosta, L. and Elhamirad, A.H., 2013. Isolation and Identification of Ginger Essential Oil. J Food Biosciences Tech, 3, 73-80.

[12]. Martins, A.P., Salgueiro, L., GoncËalves, M.J., ProencËa da Cunha, A., Vila, R., Caæigueral, S., Mazzoni, V., *et al.*, 2001. Essential Oil Composition and antimicrobial Activity of three Zingiberaceae from S.Tome Príncipe. Planta Med, 67, 580-584.

[13]. Sirat, H.M. and Leh, N.H.N., 2001. The Rhizome Oil of *Zingiber spectabile* Valet. J Essent Oil Res, 13, 256-257.

[14]. Sivasothy, Y., Awang, K., Ibrahim, H., Thong, K.L., Fitrah, N., Koh, X.P. and Tan, L.K., 2012. Chemical composition and antibacterial activities of essential oils from *Zingiber spectabile* Griff. J Essent Oil Res, 24, 305-313.

[15]. Duñg, N.X., Chińh, T.D., Rañg, D.D. and Leclercq, P.A., 1993. Chemical composition of the essential oil from rhizomes, leaves and flowers of *Zingiber zerumbet* Smith from Reunion island. J Essent Oil Res, 5, 553-555.

[16]. Sirat, H.M. and Nordin, A.B., 1994. Essential oil of *Zingiber ottensii* Valeton. J Essent Oil Res, 6, 635-636.