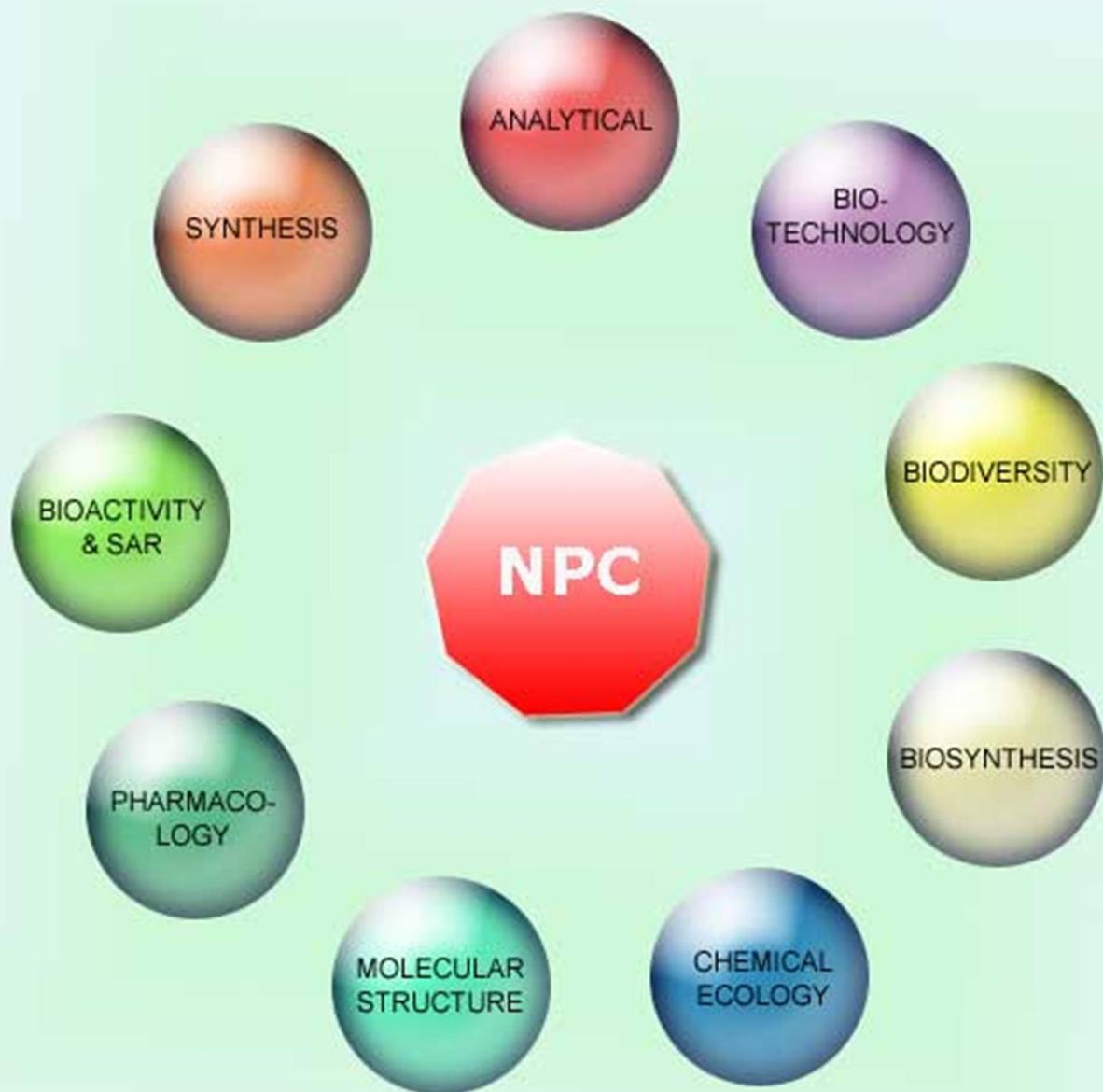


NATURAL PRODUCT COMMUNICATIONS

An International Journal for Communications and Reviews Covering all
Aspects of Natural Products Research



Volume 8. Issue 4. Pages 427-552. 2013
ISSN 1934-578X (printed); ISSN 1555-9475 (online)
www.naturalproduct.us

EDITOR-IN-CHIEF**DR. PAWAN K AGRAWAL**

Natural Product Inc.
7963, Anderson Park Lane,
Westerville, Ohio 43081, USA
agrawal@naturalproduct.us

EDITORS**PROFESSOR ALEJANDRO F. BARRERO**

Department of Organic Chemistry,
University of Granada,
Campus de Fuente Nueva, s/n, 18071, Granada, Spain
afbarre@ugr.es

PROFESSOR ALESSANDRA BRACA

Dipartimento di Chimica Bioorganica e Biofarmacia,
Università di Pisa,
via Bonanno 33, 56126 Pisa, Italy
braca@farm.unipi.it

PROFESSOR DEAN GUO

State Key Laboratory of Natural and Biomimetic Drugs,
School of Pharmaceutical Sciences,
Peking University,
Beijing 100083, China
gda5958@163.com

PROFESSOR YOSHIHIRO MIMAKI

School of Pharmacy,
Tokyo University of Pharmacy and Life Sciences,
Horinouchi 1432-1, Hachioji, Tokyo 192-0392, Japan
mimakiy@ps.toyaku.ac.jp

PROFESSOR STEPHEN G. PYNE

Department of Chemistry
University of Wollongong
Wollongong, New South Wales, 2522, Australia
spyne@uow.edu.au

PROFESSOR MANFRED G. REINECKE

Department of Chemistry,
Texas Christian University,
Forts Worth, TX 76129, USA
m.reinecke@tcu.edu

PROFESSOR WILLIAM N. SETZER

Department of Chemistry
The University of Alabama in Huntsville
Huntsville, AL 35809, USA
wsetzer@chemistry.uah.edu

PROFESSOR YASUHIRO TEZUKA

Institute of Natural Medicine
Institute of Natural Medicine, University of Toyama,
2630-Sugitani, Toyama 930-0194, Japan
tezuka@inm.u-toyama.ac.jp

PROFESSOR DAVID E. THURSTON

Department of Pharmaceutical and Biological Chemistry,
The School of Pharmacy,
University of London, 29-39 Brunswick Square,
London WC1N 1AX, UK
david.thurston@pharmacy.ac.uk

HONORARY EDITOR**PROFESSOR GERALD BLUNDEN**

The School of Pharmacy & Biomedical Sciences,
University of Portsmouth,
Portsmouth, PO1 2DT U.K.
axuf64@dsl.pipex.com

ADVISORY BOARD

Prof. Berhanu M. Abegaz
Gaborone, Botswana

Prof. Viqar Uddin Ahmad
Karachi, Pakistan

Prof. Øyvind M. Andersen
Bergen, Norway

Prof. Giovanni Appendino
Novara, Italy

Prof. Yoshinori Asakawa
Tokushima, Japan

Prof. Lee Banting
Portsmouth, U.K.

Prof. Julie Banerji
Kolkata, India

Prof. Anna R. Bilia
Florence, Italy

Prof. Maurizio Bruno
Palermo, Italy

Prof. César A. N. Catalán
Tucumán, Argentina

Prof. Josep Coll
Barcelona, Spain

Prof. Geoffrey Cordell
Chicago, IL, USA

Prof. Ana Cristina Figueiredo
Lisbon, Portugal

Prof. Cristina Gracia-Viguera
Murcia, Spain

Prof. Duvvuru Gunasekar
Tirupati, India

Prof. Kurt Hostettmann
Lausanne, Switzerland

Prof. Martin A. Iglesias Arteaga
Mexico, D. F., Mexico

Prof. Leopold Jirovetz
Vienna, Austria

Prof. Vladimir I Kalinin
Vladivostok, Russia

Prof. Niel A. Koorbanally
Durban, South Africa

Prof. Karsten Krohn
Paderborn, Germany

Prof. Chiaki Kuroda
Tokyo, Japan

Prof. Hartmut Laatsch
Gottingen, Germany

Prof. Marie Lacaillle-Dubois
Dijon, France

Prof. Shoei-Sheng Lee
Taipei, Taiwan

Prof. Francisco Macias
Cadiz, Spain

Prof. Imre Mathe
Szeged, Hungary

Prof. Ermino Murano
Trieste, Italy

Prof. M. Soledade C. Pedras
Saskatoon, Canada

Prof. Luc Pieters
Antwerp, Belgium

Prof. Peter Proksch
Düsseldorf, Germany

Prof. Phila Raharivelomanana
Tahiti, French Polynesia

Prof. Luca Rastrelli
Fisciano, Italy

Prof. Monique Simmonds
Richmond, UK

Dr. Bikram Singh
Palampur, India

Prof. John L. Sorensen
Manitoba, Canada

Prof. Valentin Stonik
Vladivostok, Russia

Prof. Winston F. Tinto
Barbados, West Indies

Prof. Sylvia Urban
Melbourne, Australia

Prof. Karen Valant-Vetschera
Vienna, Austria

INFORMATION FOR AUTHORS

Full details of how to submit a manuscript for publication in Natural Product Communications are given in Information for Authors on our Web site <http://www.naturalproduct.us>.

Authors may reproduce/republish portions of their published contribution without seeking permission from NPC, provided that any such republication is accompanied by an acknowledgment (original citation)-Reproduced by permission of Natural Product Communications. Any unauthorized reproduction, transmission or storage may result in either civil or criminal liability.

The publication of each of the articles contained herein is protected by copyright. Except as allowed under national "fair use" laws, copying is not permitted by any means or for any purpose, such as for distribution to any third party (whether by sale, loan, gift, or otherwise); as agent (express or implied) of any third party; for purposes of advertising or promotion; or to create collective or derivative works. Such permission requests, or other inquiries, should be addressed to the Natural Product Inc. (NPI). A photocopy license is available from the NPI for institutional subscribers that need to make multiple copies of single articles for internal study or research purposes.

To Subscribe: Natural Product Communications is a journal published monthly. 2013 subscription price: US\$2,395 (Print, ISSN# 1934-578X); US\$2,395 (Web edition, ISSN# 1555-9475); US\$2,795 (Print + single site online); US\$595 (Personal online). Orders should be addressed to Subscription Department, Natural Product Communications, Natural Product Inc., 7963 Anderson Park Lane, Westerville, Ohio 43081, USA. Subscriptions are renewed on an annual basis. Claims for nonreceipt of issues will be honored if made within three months of publication of the issue. All issues are dispatched by airmail throughout the world, excluding the USA and Canada.

Composition and *in vitro* Anticancer Activities of the Leaf Essential Oil of *Neolitsea variabilima* from Taiwan

Yu-Chang Su^a, Kuan-Ping Hsu^b, Eugene I-Chen Wang^b and Chen-Lung Ho^{b*}

^aDepartment of Forestry, National Chung Hsing University, 250 Kuo Kuang Rd., Taichung, Taiwan 402

^bDivision of Wood Cellulose, Taiwan Forestry Research Institute, 53, Nanhai Rd., Taipei, Taiwan 100

chenlung@tfri.gov.tw

Received: January 6th, 2013; Accepted: February 12th, 2013

This study investigated the chemical composition and *in vitro* anticancer activities of the essential oil isolated from the leaf of *Neolitsea variabilima*. The essential oil was isolated using hydrodistillation in a Clevenger-type apparatus, and characterized by GC-FID and GC-MS. Sixty-seven compounds were identified, representing 100% of the oil. The main components identified were *trans*- β -ocimene (13.4%), α -cadinol (10.5%), terpinen-4-ol (9.3%), τ -cadinol (9.2%), β -caryophyllene (8.8%), and sabinene (6.7%). The anticancer activities of oil were evaluated. The results showed that the oil exhibited cytotoxic activity against human oral, liver, lung, colon, melanoma, and leukemic cancer cells. The presence of β -caryophyllene, τ -cadinol, and α -cadinol significantly contributed to the anticancer activities of *N. variabilima* leaf oil.

Keywords: *Neolitsea variabilima*, Essential oil, Anticancer activity, β -Caryophyllene, τ -Cadinol, α -Cadinol.

Neolitsea variabilima (Hayata) Kaneh. & Sasaki (Lauraceae) (= *N. aciculata* var. *variabilima* J.C. Liao) is an endemic species of Taiwan and is distributed from the lowlands to 1500 m [1]. Few studies have investigated the chemical composition and biological activities of the essential oils or other extracts from this species. Thus, we used hydrodistillation to collect the leaf oil, and it was analyzed by GC-FID and GC-MS. In the second part of the study, we examined the *in vitro* anticancer activities of the leaf oil. The purpose of this study was to establish a chemical basis for effective multipurpose utilization of the tree species.

Hydrodistillation of *N. variabilima* leaves gave a yellow oil with a yield of 1.08 ± 0.02 mL/100 g, based on the dry weight of leaves. The identified constituents are presented in Table 1, where all compounds are listed in order of their elution from the DB-5 column. Sixty-seven compounds were identified (Table 1), representing 100.0% of the oil. Among the groups, monoterpene hydrocarbons were predominant (36.1%), followed by oxygenated sesquiterpenes (25.9%), sesquiterpene hydrocarbons (23.2%), and oxygenated monoterpenes (14.9%). Among the monoterpene hydrocarbons, *trans*- β -ocimene (13.4%) and sabinene (6.7%) were the major compounds. Of the oxygenated sesquiterpenes, α -cadinol (10.5%) and τ -cadinol (9.2%) were the chief compounds, whereas of the sesquiterpene hydrocarbons, β -caryophyllene (8.8%) was the major component. Terpinen-4-ol (9.3%) was the chief components among the oxygenated monoterpenes. Other representative compounds were α -pinene (3.1%), β -pinene (2.6%), 1,8-cineole (2.5%), γ -terpinene (3.7%), and bicyclogermacrene (2.0%).

Although the leaf oil constituents of *N. variabilima* was primarily monoterpenoids, like those of *N. oblongifolia* and *N. umbrosa* [2], their main components differed. Further comparison with the leaf oil of *N. aciculata* [3a], *N. parvigemma* [3b], *N. pallens* [3c], *N. australiensis*, *N. brassii*, *N. dealbata* [3d], *N. sericea* [3e], *N. foliosa* var. *caesia* [3f] and *N. fischeri* [3g], were predominantly sesquiterpenoids and differed from the leaf oil of *N. variabilima*.

To evaluate the anticancer activities of leaf essential oil of *N. variabilima* from Taiwan, we tested the effect of essential oil on the viability of six human cancer cell lines: OEC-M1 (human oral squamous) cells, J5 (human hepatocellular carcinoma) cells, A549 (human lung adenocarcinoma) cells, HT-29 (human colon) cells, UACC-62 (human melanoma) cells, and K562 (human leukemic) cells. Cells were incubated with various concentrations of essential

oil for 48 h, and then cell viabilities were measured by the alamarBlue® proliferation assay. The results showed that oil treatment for 48 h reduced the viability of OEC-M1 cells, J5 cells, A549 cells, HT-29 cells, UACC-62 cells, and K562 cells, with IC₅₀ values around 38.9, 42.6, 36.9, 16.8, 8.8, and 8.6 μ g/mL, respectively (Table 2). This is the first report on the anticancer activities of *N. variabilima* leaf essential oil.

However, to ascertain the compounds responsible for the anticancer activities of *N. variabilima* leaf oil, the main components were individually tested for their anticancer activities. Sabinene, *trans*- β -ocimene, terpinen-4-ol, β -caryophyllene were purchased from the Fluka Co. (Milwaukee, USA), τ -cadinol, and α -cadinol were isolated from the essential oil of *M. philippinensis* according to the method proposed by Ho *et al.* [4a]. The results showed that the active compounds were β -caryophyllene, τ -cadinol, and α -cadinol. The IC₅₀ values of the three compounds against the six cancer cells were 24.0, 18.9, and 9.9 μ g/mL against OEC-M1 cells; 111.2, 38.6, and 12.1 μ g/mL against J5 cells; 31.3, 18.6, and 10.8 μ g/mL against A549 cells; 9.8, 30.6, and 0.8 μ g/mL against HT-29 cells; 3.2, 2.5, and 1.3 μ g/mL against UACC-62 cells; and 4.6, 3.6, and 2.8 μ g/mL against K562 cells, respectively (Table 2). β -Caryophyllene is reported to be cytotoxic against a number of human cancer cell lines including MCF-7, MDA-MB-468, UACC-257, A549, Hela, and HT-29 [4b, 4c]. τ -Cadinol has been reported to be cytotoxic to A549, MCF-7, and HT-29 [4d]. α -Cadinol is also reported to be cytotoxic against three human cancer cell lines, including A-549, MCF-7, and HT-29 [4e]. The presence of β -caryophyllene, τ -cadinol, and α -cadinol significantly contributed to the anticancer activities of *N. variabilima* leaf oil.

Experimental

Plant materials: Fresh leaves of *N. variabilima* were collected in June 2012 from Lienhuachih Research Center of the Taiwan Forestry Research Institute in central Taiwan (Nantou County, elevation 600 m, N 23° 55' 08", 120° 52' 85"). The samples were compared with specimen no. ou 10896 from the Herbarium of National Chung-Hsing University and positively identified by Prof. Yen-Hsueh Tseng of NCHU. The voucher specimen (CLH-028) was deposited in the NCHU herbarium. Leaves of the species were collected for subsequent extraction and analysis.

Isolation and Analysis essential oil: Leaves of *N. variabilima* (1 Kg) was hydrodistilled for 8 h with 3 L of distilled water. The

Table 1: Chemical composition of the leaf essential oil of *N. variabilima*.

Constituents	KI ^a	Content(%)	Identification ^b
α -Thujene	930	0.9	MS, KI, ST
α -Pinene	939	3.1	MS, KI, ST
Camphene	954	0.1	MS, KI, ST
Sabinene	975	6.7	MS, KI, ST
β -Pinene	979	2.6	MS, KI, ST
β -Myrcene	990	0.9	MS, KI, ST
α -Phellandrene	1002	0.1	MS, KI, ST
α -Terpinene	1017	1.6	MS, KI, ST
<i>p</i> -Cymene	1024	0.2	MS, KI, ST
Limonene	1029	1.4	MS, KI, ST
1,8-Cineole	1031	2.5	MS, KI, ST
<i>cis</i> - β -Ocimene	1037	0.6	MS, KI, ST
2-Heptyl acetate	1043	0.1	MS, KI
<i>trans</i> - β -Ocimene	1044	13.4	MS, KI, ST
γ -Terpinene	1060	3.7	MS, KI, ST
Terpinolene	1088	0.8	MS, KI, ST
Linalool	1096	0.7	MS, KI, ST
<i>cis</i> -Thujone	1102	0.3	MS, KI
2-Isopropyl-5-methyl-(2 <i>E</i>)-hexenal	1104	0.3	MS, KI
2-Isopropyl-5-methyl-(2 <i>Z</i>)-hexenal	1114	0.2	MS, KI
Terpinen-4-ol	1177	9.3	MS, KI, ST
α -Terpineol	1189	0.8	MS, KI, ST
<i>trans</i> -Piperitol	1208	0.1	MS, KI, ST
Bornyl acetate	1288	0.3	MS, KI, ST
Linalool propanoate	1337	0.0	MS, KI
δ -Elemene	1338	0.3	MS, KI
α -Cubebene	1345	0.2	MS, KI, ST
Neryl acetate	1361	0.2	MS, KI, ST
β -Elemene	1390	1.3	MS, KI, ST
α -Gurjunene	1409	0.3	MS, KI, ST
α -Cedrene	1411	0.2	MS, KI
β -Caryophyllene	1419	8.8	MS, KI, ST
β -Cedrene	1420	0.1	MS, KI
<i>p</i> -Cymen-7-ol acetate	1422	0.2	MS, KI
β -Copaene	1432	0.1	MS, KI, ST
Aromadendrene	1441	0.7	MS, KI, ST
<i>cis</i> -Muurolo-3,5-diene	1449	0.1	MS, KI
<i>trans</i> -Muurolo-3,5-diene	1453	0.3	MS, KI
α -Humulene	1454	0.9	MS, KI, ST
<i>allo</i> -Aromadendrene	1460	0.4	MS, KI
<i>trans</i> -Cadina-1(6),4-diene	1476	0.5	MS, KI
γ -Muurolole	1479	0.5	MS, KI
Germaecene D	1485	0.4	MS, KI, ST
β -Selinene	1490	0.9	MS, KI
Valencene	1496	0.8	MS, KI
Bicyclogermaecene	1500	2.0	MS, KI
α -Muurolole	1500	0.1	MS, KI
γ -Cadinene	1513	1.0	MS, KI
<i>cis</i> - γ -Bisabolene	1515	0.4	MS, KI
δ -Cadinene	1523	1.8	MS, KI
Zonarene	1529	0.3	MS, KI
γ -Cuprenene	1533	0.2	MS, KI
<i>trans</i> -Cadina-1,4-diene	1534	0.2	MS, KI
α -Cadinene	1538	0.2	MS, KI
α -Copen-11-ol	1541	0.4	MS, KI
Elemol	1550	0.2	MS, KI, ST
Germaecene B	1561	0.5	MS, KI
Caryophyllenyl alcohol	1572	0.2	MS, KI, ST
Spathulenol	1578	1.3	MS, KI, ST
Caryophyllene oxide	1583	0.4	MS, KI, ST
Globulol	1590	0.7	MS, KI, ST
Ledol	1602	0.6	MS, KI
Humulene epoxide II	1608	0.2	MS, KI
1- <i>epi</i> -Cubenol	1628	0.7	MS, KI
τ -Cadinol	1640	9.2	MS, KI, ST
τ -Muurolole	1642	1.6	MS, KI, ST
α -Cadinol	1654	10.5	MS, KI, ST
Monoterpene hydrocarbons (%)		36.1	
Oxygenated monoterpenes (%)		14.9	
Sesquiterpene hydrocarbons (%)		23.2	
Oxygenated sesquiterpenes (%)		25.9	
Yield (mL/100g)		1.1 \pm 0.03	

^a Kovats index on a DB-5 column with reference to *n*-alkanes [5]. ^b MS, NIST and Wiley library spectra and the literature; KI, Kovats index; ST, authentic standard compounds.

essential oil obtained was dried with anhydrous sodium sulfate. The oil yield and all test data are the average of triplicate analyses. A

Hewlett-Packard HP 6890 gas chromatograph equipped with a DB-5 fused silica capillary column (30 m x 0.25 mm x 0.25 μ m film thickness, J&W Scientific) and a FID detector was used for the quantitative determination of oil components. Oven temperature was programmed as follows: 50°C for 2 min, rising to 250°C at 5°C/min. Injector temperature: 270°C. Carrier gas: Helium with a flow rate of 1 mL/min. Detector temperature: 250°C, split ratio: 1:10. Diluted samples (1.0 μ L, 1/100, v/v, in ethyl acetate) were injected manually in the split mode. Identification of the oil components was based on their retention indices and mass spectra, obtained from GC/MS analysis on a Hewlett-Packard HP 6890/HP5973 equipped with a DB-5 fused silica capillary column (30 m x 0.25 mm x 0.25 μ m film thickness, J&W Scientific). The GC analysis parameters are listed above and the MS were obtained (full scan mode: scan time: 0.3 s, mass range was *m/z* 30-500) in the EI mode at 70 eV. All data were the average of triplicate analyses.

Component identification: Identification of the leaf essential oil constituents was based on comparisons of retention index (RI) [15], retention times (RT), and mass spectra with those obtained from authentic standards and/or the NIST and Wiley libraries spectra, and literature [5, 6].

Cell culture: Human oral squamous cancer OEC-M1 cells, human hepatocellular carcinoma J5 cells, human lung adenocarcinoma A549 cells, human colon cancer HT-29 cells, human melanoma UACC-62 cells, and human leukemic cell K562 cells were obtained from ATCC (Rockville, MD, USA) and multiplied in RPMI-1640 medium supplemented with 10% heated-inactivated FCS and 2 mM L-glutamine (Life Technologies, Inc., MD), and incubated at 37°C with 5% CO₂ incubator and 95% humidity.

Cell viability assay: The cytotoxicity of the essential oil was assessed using the alamarBlue® proliferation assay according to a protocol from AbD Serotec. Cells (3000 cells/well) were incubated with either essential oils (dissolved in DMSO, final 0.1% DMSO in medium) or vehicle control (0.1% DMSO) for 24 h and 48 h, followed by replacing with fresh medium containing 10% alamarBlue® reagent for an additional 6 h. The absorbances at 570 nm and 600 nm were measured by a microplate reader. All data were the average of triplicate analyses [7].

Table 2: IC₅₀ values of *N. variabilima* leaf oil and its' main constituents against cancer cell lines.

Cell lines ^a	Essential oil	IC ₅₀ (μ g/mL)					
		Compounds ^b					
		1	2	3	4	5	6
OEC-M1	38.9	>200	>200	>200	24	18.9	9.9
J5	42.6	>200	>200	>200	111.2	38.6	12.1
A549	36.9	>200	>200	>200	31.3	18.6	10.8
HT-29	16.8	>200	>200	>200	9.8	30.6	0.8
UACC-62	8.8	>200	>200	>200	3.2	2.5	1.3
K562	8.6	>200	>200	>200	4.6	3.6	2.8

^a Cell lines: OEC-M1 (human oral squamous); J5 (human hepatocellular carcinoma); A549 (human lung adenocarcinoma); HT-29 (human colon); UACC-62 (human melanoma); K562 (human leukemic). ^b 1. Sabinene; 2. *trans*- β -Ocimene; 3. Terpinen-4-ol; 4. β -Caryophyllene; 5. τ -Cadinol; 6. α -Cadinol.

References

- [1] Yang YP, Liu HY. (1999) *Manual of Taiwan vascular plants*. Council of Agriculture, Executive Yuan, Taipei.
- [2] Zhu L, Li Y, Baoling, Li B, Xia N. (1993) *Aromatic Plants and Essential Constituents*, Hai Feng, Hong Kong, pp. 40, 225.
- [3] (a) Kim SS, Kim JE, Hyun CG, Lee, NH. (2011) *Neolitsea aciculata* essential oil inhibits drug-resistant skin pathogen growth and propionic-bacterium acnes-induced inflammatory effects of human monocyte leukemia. *Natural Product Communications*, **6**, 1193-1198; (b) Ho CL, Liao PC, Wang EIC, Su YC. (2011) Composition and antifungal activities of the leaf essential oil of *Neolitsea parvigemma* from Taiwan. *Natural Product Communications*, **6**, 1357-1360; (c) Padalia RC, Chanotiya CS, Thakuri BC, Mathela CS. (2007) Germacranolide rich essential oil from *Neolitsea pallens*. *Natural Product Communications*, **2**, 591-593; (d) Brophy JJ, Goldsack RJ, Fookes CJR, Forster PI. (2002) The leaf oils of the Australian species of *Neolitsea* (Lauraceae). *Journal of Essential Oil Research*, **14**, 191-195; (e) Hayashi N, Komae H. (1980) Chemistry and distribution of sesquiterpene furans in Lauraceae. *Biochemical Systematics and Ecology*, **8**, 381-383; (f) Ramona C, Anita B, John AJ, Karunakaran VP, George V, Pradeep NS, Sethuraman MG. (2007) Chemical Composition and antibacterial activity of leaf oil of *Neolitsea filiosa* (Nees) Gamble var. *caesia* (Meisner) Gamble. *Journal of Essential Oil Research*, **19**, 498-500; (g) John AJ, George V, Pradeep NS, Sethuraman MG. (2008) Chemical composition and antibacterial activity of the leaf, bark and fruit oils of *Neolitsea fischeri* Gamble. *Journal of Essential Oil Research*, **20**, 279-281.
- [4] (a) Ho CL, Hsu KP, Wang EIC, Lin CY, Su YC. (2010) Composition and anti-wood-decay fungal activities of the leaf essential oil of *Machilus philippinensis* from Taiwan. *Natural Product Communications*, **5**, 337-340; (b) Cole RA, Bansal A, Debra Moriarity DM, Haber WA, Setzer WN. (2007) Chemical composition and cytotoxic activity of the leaf essential oil of *Eugenia zuchowskiae* from Monteverde, Costa Rica. *Journal of Natural Medicines*, **61**, 414-417; (c) Silva SL, Chaar JS, Figueiredo PMS, Yano T. (2008) Cytotoxic evaluation of essential oil from *Casearia sylvestris* Sw on human cancer cells and erythrocytes. *Acta Amazonica*, **38**, 107-112; (d) Chang ST, Wang SY, Wu CL, Shiah SG, Kuo YH, Chang CJ. (2000) Cytotoxicity of extractives from *Taiwania cryptomerioides* heartwood. *Phytochemistry*, **55**, 227-232; (e) He K, Zeng L, Shi G, Zhao GX, Kozlowski JF, McLaughlin JL. (1997) Bioactive Compounds from *Taiwania cryptomerioides*. *Journal of Natural Products*, **60**, 38-40.
- [5] Adams RP. (2001) *Identification of Essential Oil Components by Gas Chromatography/Quadrupole Mass Spectroscopy*, Allured, Carol Stream, IL.
- [6] Massada Y. (1976) *Analysis of Essential Oil by Gas Chromatography and Spectrometry*, Wiley, New York.
- [7] Su YC, Hsu KP, Eugene ICW, Ho CL. (2012) Composition, anticancer, and antimicrobial activities *in vitro* of the heartwood essential oil of *Cunninghamia lanceolata* var. *konishii* from Taiwan. *Natural Product Communications*, **7**, 1245-1247.

Volatile Composition of Six Horsetails: Prospects and Perspectives Françoise Fons, Didier Froissard, Jean-Marie Bessière, Alain Fruchier, Bruno Buatois and Sylvie Rapior	509
Chemical Compositions of the Rhizome, Leaf and Stem Oils from Malaysian <i>Hornstedtia leonurus</i> Nor Akmalazura Jani, Hasnah Mohd. Sirat, NorAzah Mohamad Ali and Azrina Aziz	513
Effect on Emotional Behavior and Stress by Inhalation of the Essential oil from <i>Chamaecyparis obtusa</i> Hikaru Kasuya, Erika Hata, Tadaaki Satou, Masaki Yoshikawa, Shinichiro Hayashi, Yoshinori Masuo and Kazuo Koike	515
Chemical Composition and Antibacterial Activity of Rhizome Oils from Five <i>Hedychium</i> Species Ratchuporn Suksathan, Siriwoot Sookkhee, Somboon Anuntalabhochai and Sunee Chansakaow	519
Chemical Composition and Antimicrobial Activity of Three Essential Oils from <i>Curcuma wenyujin</i> Jingjing Zhu, Agnieszka D. Lower-Nedza, Meng Hong, Song Jiec, Zhimin Wang, Dong Yingmao, Christine Tschiggerl, Franz Bucar and Adelheid H. Brantner	523
Essential Oil Composition and Antimicrobial Activity of Aerial Parts and Ripe Fruits of <i>Echinophora spinosa</i> (Apiaceae) from Italy Daniele Fraternali, Salvatore Genovese and Donata Ricci	527
Composition and <i>in vitro</i> Anticancer Activities of the Leaf Essential Oil of <i>Neolitsea variabilissima</i> from Taiwan Yu-Chang Su, Kuan-Ping Hsu, Eugene I-Chen Wang and Chen-Lung Ho	531
<u>Review/Account</u>	
Natural Products from Marine Algae of the Genus <i>Osmundaria</i> (Rhodophyceae, Ceramiales) Kelvin Osako and Valéria Laneuville Teixeira	533
Phenols, Alkaloids and Terpenes from Medicinal Plants with Antihypertensive and Vasorelaxant Activities. A Review of Natural Products as Leads to Potential Therapeutic Agents Francesco Maione, Carla Cicala, Giulia Musciacco, Vincenzo De Feo, Anibal G. Amat, Armando Ialenti and Nicola Mascolo	539
Diosmin – Isolation Techniques, Determination in Plant Material and Pharmaceutical Formulations, and Clinical Use Anna Bogucka – Kocka, Michał Woźniak, Marcin Feldo, Janusz Kocki and Katarzyna Szewczyk	545

Natural Product Communications

2013

Volume 8, Number 4

Contents

<u>Original Paper</u>	<u>Page</u>
Anti-melanogenesis Constituents from the Seaweed <i>Dictyota coriacea</i> Ryeo Kyeong Ko, Min-Chul Kang, Sang Suk Kim, Tae Heon Oh, Gi-Ok Kim, Chang-Gu Hyun, Jin Won Hyun and Nam Ho Lee	427
Methyl Carnosate, an Antibacterial Diterpene Isolated from <i>Salvia officinalis</i> Leaves Elisa Klimati, Fabio Mastrogiovanni, Maria Valeri, Laura Salvini, Claudia Bonechi, Nilufar Zokirzhonovna Mamadalieva, Dilfuza Egamberdieva, Anna Rita Taddei and Antonio Tiezzi	429
Cytotoxicity of Meroterpenoids from <i>Sargassum siliquastrum</i> against Human Cancer Cells Jung Im Lee, Myoung K. Kwak, Hee Y. Park and Youngwan Seo	431
Isolation of Methyl 27-caffeoyloxyoleanolate – A New Oleanane Triterpenoid from the Roots of <i>Hibiscus vitifolius</i> Duraismy Ramasamy and Ariamuthu Saraswathy	433
Synthesis and Cytotoxic Activity of New Betulin and Betulinic Acid Esters with Conjugated Linoleic Acid (CLA) Barbara Tubek, Pawel Mitula, Natalia Niezgoda, Katarzyna Kempinska, Joanna Wietrzyk and Czeslaw Wawrzenczyk	435
Analysis of Pyrrolizidine Alkaloids and Evaluation of Some Biological Activities of Algerian <i>Senecio delphinifolius</i> (Asteraceae) Soukaina Tidjani, Philippe N. Okusa, Amar Zellagui, Laetitia Moreno Y Banuls, Caroline Stévigny, Pierre Duez and Salah Rhouati	439
Berberine: a New Isoquinoline-isoquinolone Alkaloid from <i>Berberis vulgaris</i> (Berberidaceae) Anna Hošťálková, Zdeněk Novák, Milan Pour, Anna Jirošová, Lubomír Opletal, Jiří Kuneš and Lucie Cahliková	441
Dicentrine Production in Callus and Cell Suspension Cultures of <i>Stephania venosa</i> Tharita Kitisripanya, Jukrapun Komaikul, Nirachara Tawinkan, Chuennapha Atsawinkowit and Waraporn Putalun	443
New Flavan and Alkyl α,β-Lactones from the Stem Bark of <i>Horsfieldia superba</i> Nabil Ali Al-Mekhlafi, Khozirah Shaari, Faridah Abas, Ethyl Jeyaseela Jeyaraj, Johnson Stanslas, Shaik Ibrahim Khalivulla and Nordin H. Lajis	447
New Flavonol Triglycosides from the Leaves of Soybean Cultivars Yoshinori Murai, Ryoji Takahashi, Felipe Rojas Rodas, Junichi Kitajima and Tsukasa Iwashina	453
Melitidin: A Flavanone Glycoside from <i>Citrus grandis</i> ‘Tomentosa’ Wei Zou, Yonggang Wang, Haibin Liu, Yulong Luo, Si Chen and Weiwei Su	457
Two New Chalcones from the Flowers of <i>Clerodendrum inerme</i> Shaik Khadar Shahabuddin, Rachakunta Munikishore, Golakoti Trimurtulu, Duvvuru Gunasekar, Alexandre Deville and Bernard Bodo	459
A Novel Phenolic Compound from <i>Phyllanthus emblica</i> Gaimei She, Ruiyang Cheng, Lei Sha, Yixia Xu, Renbin Shi, Lanzhen Zhang and Yajian Guo	461
Anti-austeric Activity of Phenolic Constituents of Seeds of <i>Arctium lappa</i> Yasuhiro Tezuka, Keiichi Yamamoto, Suresh Awale, Feng Li, Satoshi Yomoda and Shigetoshi Kadota	463
Bioactive Lignans from the Leaves and Stems of <i>Schisandra wilsoniana</i> Guang-Yu Yang, Rui-Rui Wang, Zhong-Hua Gao, Yin-Ke Li, Liu-Meng Yang, Xiao-Nian Li, Shan-Zhai Shang, Yong-Tang Zheng, Wei-Lie Xiao and Han-Dong Sun	467
Antioxidative / Acetylcholinesterase Inhibitory Activity of Some Asteraceae Plants Ivana Generalić Mekinić, Franko Burčul, Ivica Blažević, Danijela Skroza, Daniela Kerum and Višnja Katalinić	471
Antioxidant and Antimicrobial Activities, and Phenolic Compounds of Selected <i>Inula</i> species from Turkey Alper Gökbulut, Onural Özhan, Basri Satılmış, Kadir Batçoğlu, Selami Günel and Engin Şarer	475
Two New Dihydrostilbenoid Glycosides Isolated from the Leaves of <i>Litsea coreana</i> and their Anti-inflammatory Activity Wenjian Tang, Weili Lu, Xiaoqing Cao, Yilong Zhang, Hong Zhang, Xiongwen Lv and Jun Li	479
Inhibitory Activity of Benzophenones from <i>Anemarrhena asphodeloides</i> on Pancreatic Lipase Yang Hee Jo, Seon Beom Kim, Jong Hoon Ahn, Qing Liu, Bang Yeon Hwang and Mi Kyeong Lee	481
Identification and Quantification of Furanocoumarins in Stem Bark and Wood of Eight Algerian Varieties of <i>Ficus carica</i> by RP-HPLC-DAD and RP-HPLC-DAD-MS Samia Rouaiguia-Bouakkaz, Habiba Amira-Guebailia, Céline Rivière, Jean-Claude Delaunay, Pierre Waffo-Téguo and Jean-Michel Mérillon	485
UPLC-Q-TOF/MS Coupled with Multivariate Statistical Analysis as a Powerful Technique for Rapidly Exploring Potential Chemical Markers to Differentiate Between <i>Radix Paeoniae Alba</i> and <i>Radix Paeoniae Rubra</i> Nian-cui Luo, Wen Ding, Jing Wu, Da-wei Qian, Zhen-hao Li, Ye-fei Qian, Jian-ming Guo and Jin-ao Duan	487
Antimicrobial Activity of Crude Methanolic Extract from <i>Phyllanthus niruri</i> Darah Ibrahim, Lim Sheh Hong and Ninthianantham Kuppan	493
Cellulose Contents of Some Abundant Indian Seaweed Species Arup K. Siddhanta, Sanjay Kumar, Gaurav K. Mehta, Mahesh U. Chhatbar, Mihir D. Oza, Naresh D. Sanandiya, Dharmesh R. Chejara, Chirag B. Godiya and Stalin Kondaveeti	497
Anti-inflammatory Potential of Silk Sericin Pornanong Aramwit, Pasarapa Towiwat and Teerapol Srichana	501
Composition of Essential Oil from Aerial and Underground Parts of <i>Geum rivale</i> and <i>G. urbanum</i> Growing in Poland Aleksandra Owczarek, Jan Gudej and Agnieszka Kice	505

Continued Inside backcover