Natural Product Research

Country United Kingdom - SIR Ranking of United Kingdom

Subject Area and Category
Agricultural and Biological Sciences
Plant Science
Biochemistry, Genetics and Molecular Biology
Biochemistry
Chemistry
Analytical Chemistry
Organic Chemistry

Publisher Taylor & Francis

Publication type Journals

ISSN 14786419

Coverage 2003-ongoing

Scope The aim of Natural Product Research is to publish important contributions in the field of natural product chemistry. The journal covers all aspects of research in the chemistry and biochemistry of naturally occurring compounds. The communications include coverage of work on natural substances of land and sea and of plants, microbes and animals. Discussions of structure elucidation, synthesis and experimental biosynthesis of natural products as well as developments of methods in these areas are welcomed in the journal. Finally, research papers in fields on the chemistry-biology boundary, eg. fermentation chemistry, plant tissue culture investigations etc., are accepted into the journal.

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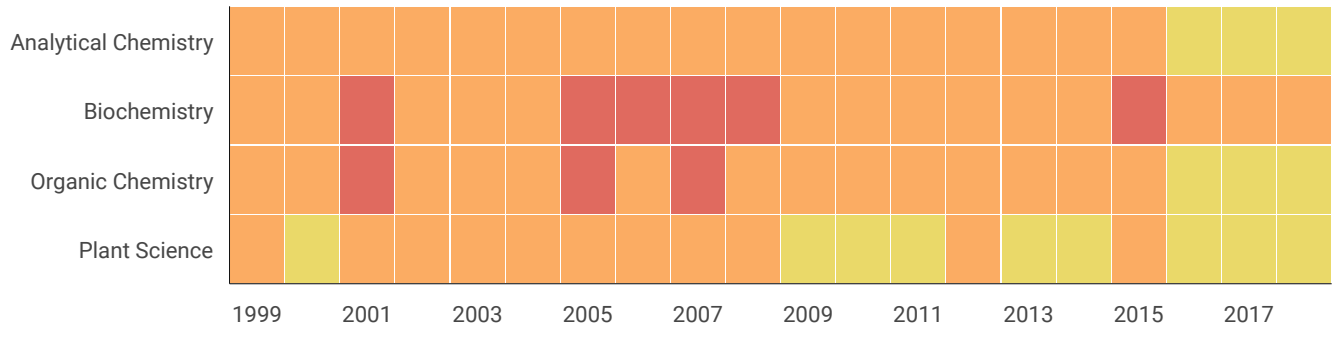

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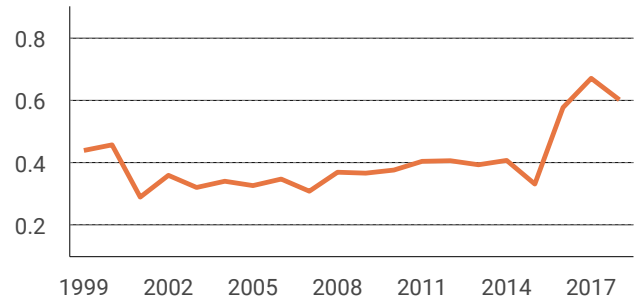

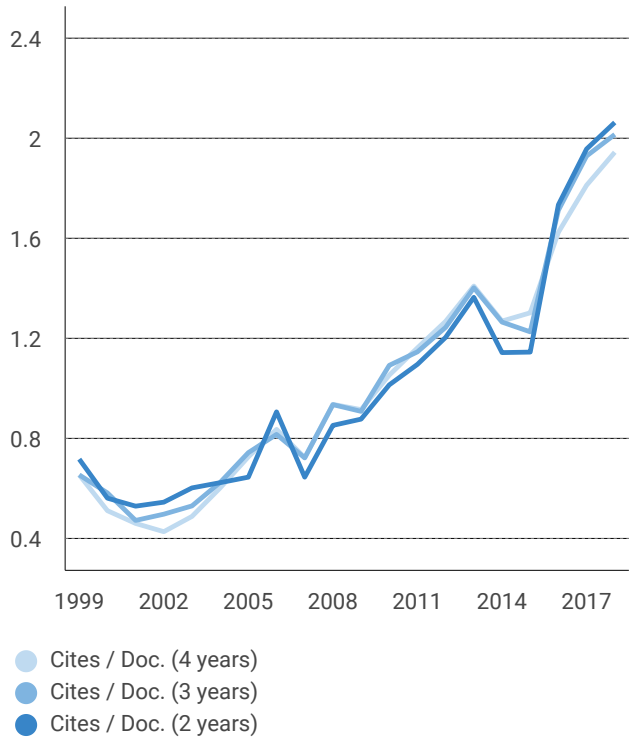

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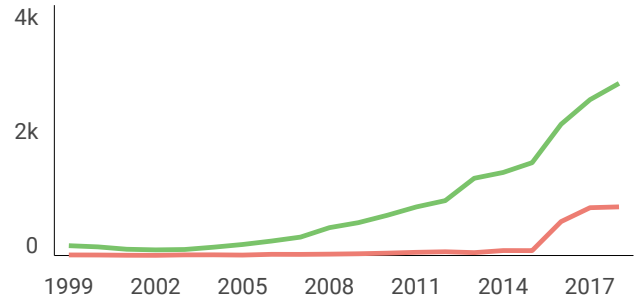

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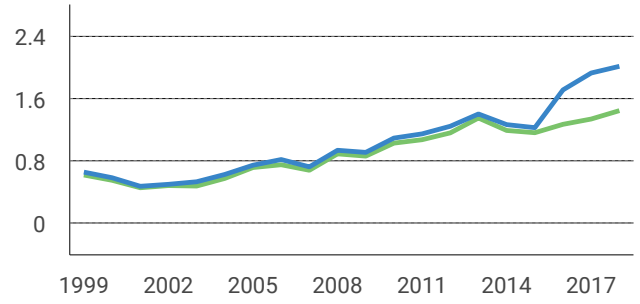

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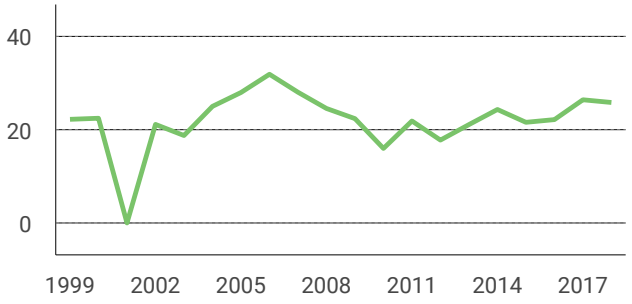

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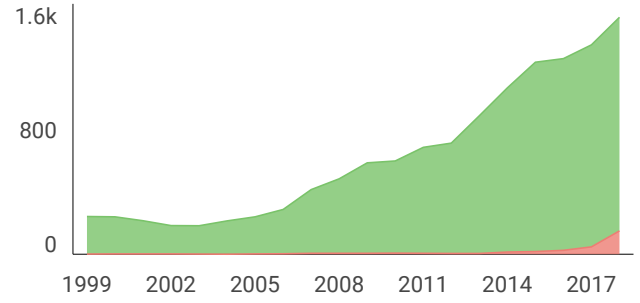

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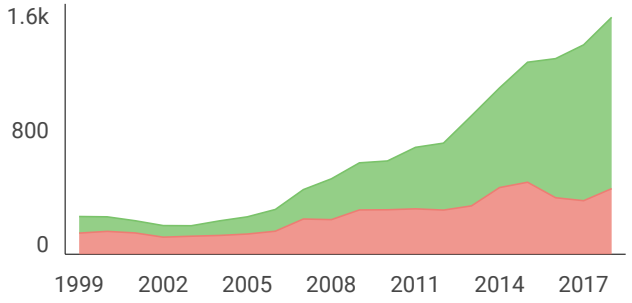

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Natural Product Research ›
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Aims and scope

The aim of ***Natural Product Research*** is to publish important contributions in the field of natural product chemistry. The journal covers all aspects of research in the chemistry and biochemistry of naturally occurring compounds.

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Journal information

Print ISSN: 1478-6419 Online ISSN: 1478-6427

24 issues per year

Natural Product Research is indexed in: Cambridge Crystallographic Data Centre; Chemical Abstracts Service; Embase; Google Scholar; MEDLINE; Microsoft Academic; ProQuest; Science Citation Index Expanded and Scopus.

Publication history

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Formerly known as

Natural Product Letters (1992 - 2002)

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Latest articles

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Rapid communication

GC-MS investigation and antiproliferative activities of extracts from male and female flowers of *Schinus molle* L. ›

Elisa Ovidi, Stefania Garzoli, Valentina Laghezza Masci, Giovanni Turchetti & Antonio Tiezzi

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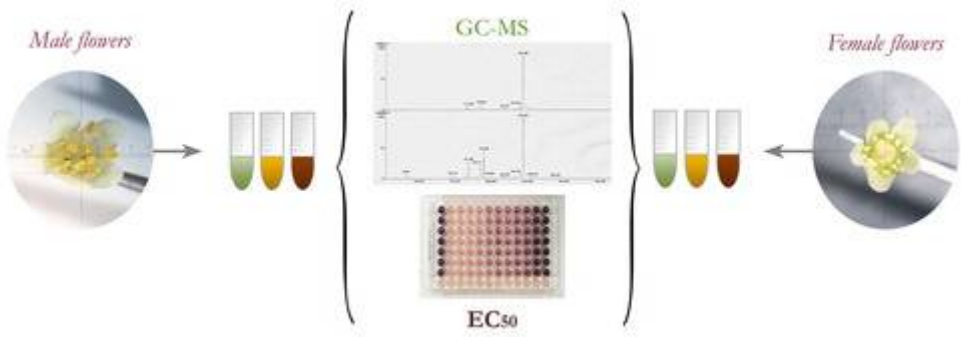
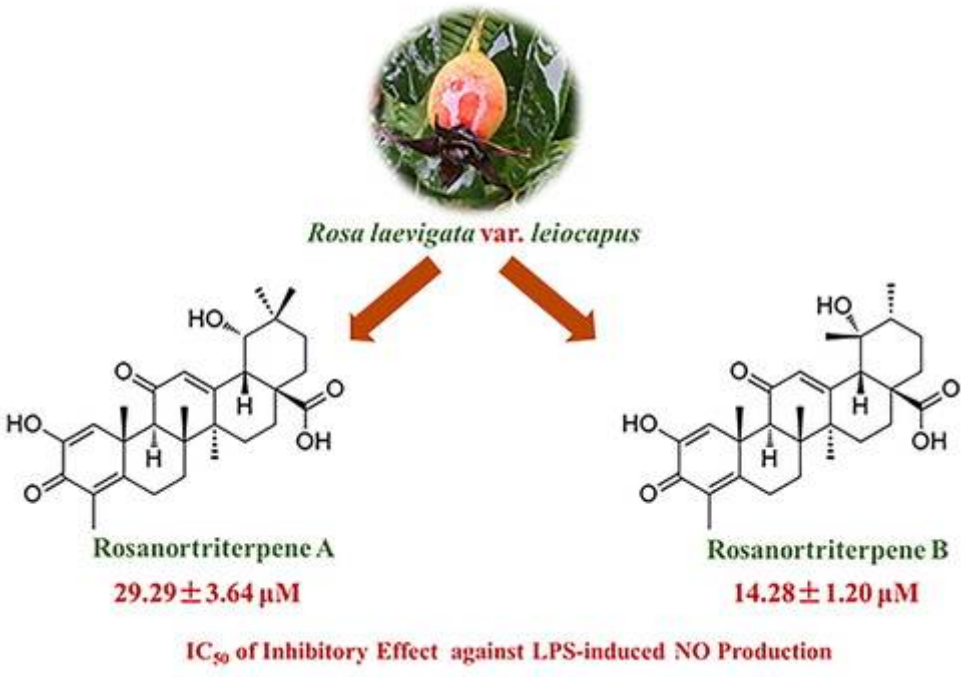


Research Article

Rosa laevigata var. *leiocapus* ›

Yu-Nong Tian, Bai-Lin Li, Juan-Juan Hu, Jin-Dan Xie, Wen-Jing Xiao, Ling-Hui Nie & Jie-Wei Wu

Published online: 22 Jul 2019



Short Communication

Rapid communication

Chemical composition, antioxidant and antiprotozoal activity of *Eugenia gracillima* Kiaersk. leaves essential oil ›

Mariana Gomes Vidal Sampaio, Cícero Ramon Bezerra Dos Santos, Lilian Cortez Sombra Vandesmet, Bruno Souza Dos Santos, Izabelly Bianca Da Silva Santos, Maria Tereza dos Santos Correia, Arthur Lima de Berrêdo Martins, Luis Claudio Nascimento da Silva, Irwin Rose De Alencar Menezes, Maria Celeste Veja Gomez & Márcia Vanusa Da Silva

Published online: 22 Jul 2019

Antioxidant and antileishmanial potential

Research Article

Article

Three new pterocarpans from the aerial parts of *Abrus Precatorius* ›

Yan Li, Jie-Wei Wu, Hai-Bo Tan, Bai-Lin Li & Sheng-Xiang Qiu

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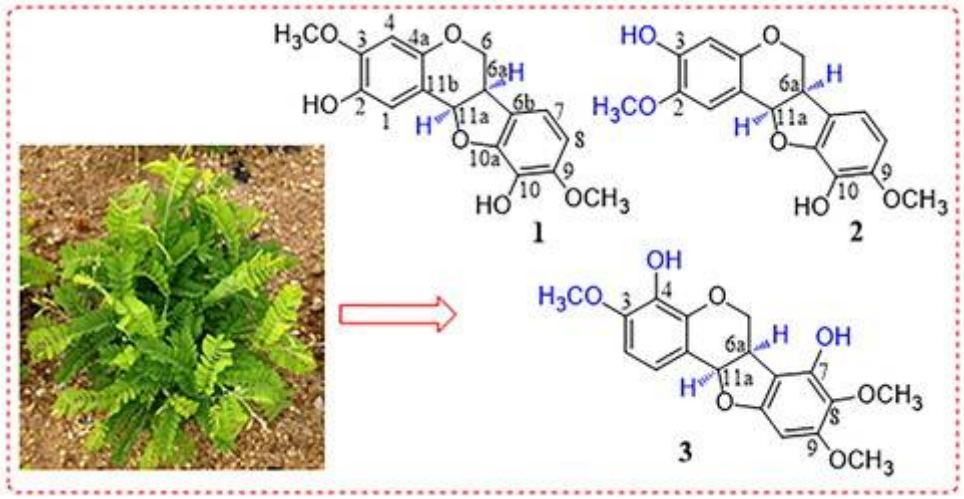

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Stercufoetin A, new oleanane-type triterpenoid from the leaves of *Sterculia foetida* L. ›

Nguyen Kim Tuyen Pham, Trung Duan Nguyen, Tran Duy Cuong Doan, Tuan Dat Ha, Nguyen Minh An Tran, Trong Duc Tran, Dinh Tri Mai & Tan Phat Nguyen

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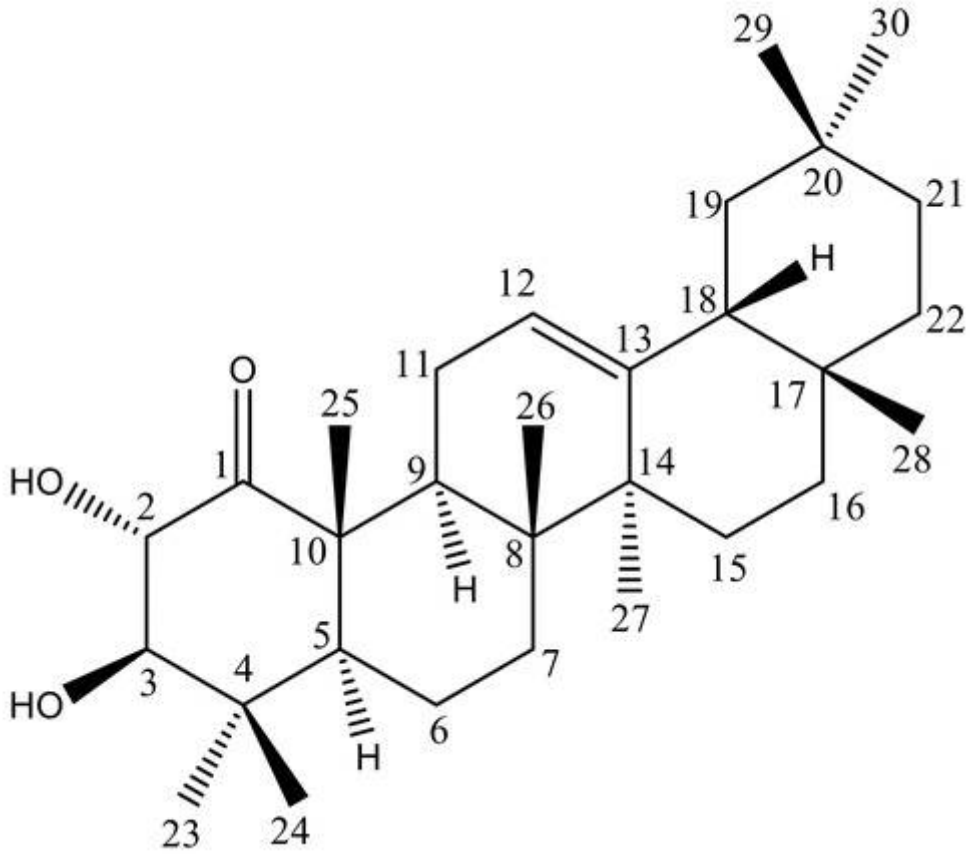

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Calodioscurins A and B, two new isoprenylated xanthones from the stem bark of *Calophyllum dioscurii* P.F. Stevens ›

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M. L. Bhavya, R. Ravi & M. Madhava Naidu

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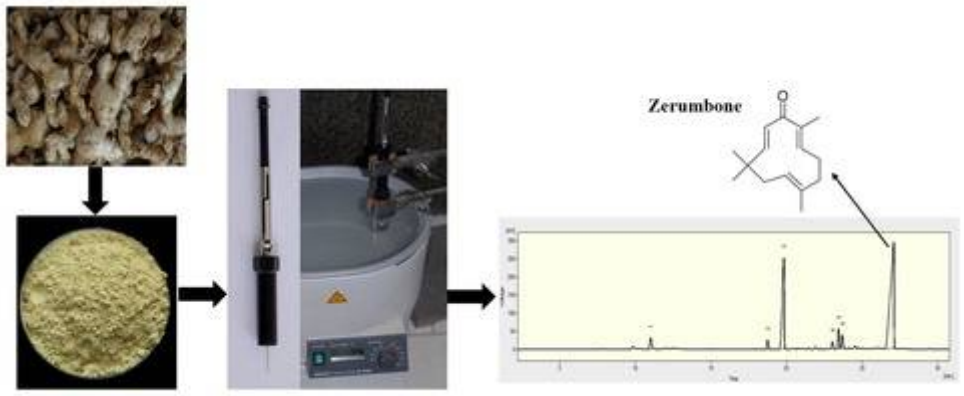

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Article

Diarylpropanes from *Horsfieldia kingii* ›

Bo Liu, Ye-Gao Chen, Xing-Jun Tian & Rui Zhan

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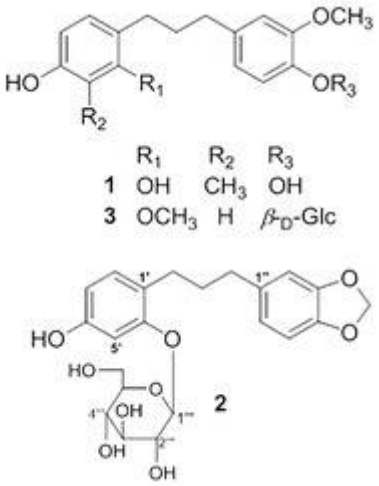

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Bicyclic lactones from the octocoral *Dendronephthya mucronata* ›

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Linfeng Zheng, Dongdong Zhang, Yuze Li, Wenli Huang, Xinjie Yang, Huawei Zhang, Pu Jia, Zhenggang Yue & Xiaomei Song

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Antifungal activity of essential oil from *Mentha spicata* L. and *Mentha pulegium* L. growing wild in Sardinia island (Italy) ›

A. Piras, S. Porcedda, D. Falconieri, A. Maxia, Mj. Gonçalves, C. Cavaleiro & L. Salgueiro

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Two new steroids with NO inhibitory effects from *lansium domesticum* ›

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The identification of phenylpropanoids isolated from the root bark of *Ailanthus altissima* (Mill.) Swingle ›

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Isolates From *Thymelaea Hirsuta* Inhibit Progression Of Hepatocellular Carcinoma *In Vitro* And *In Vivo*

Ahmed Badawy, Hashim Hassanean, Amany K. Ibrahim, Eman S. Habib, Mohammed A. El-Magd & Safwat A. Ahmed

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Simultaneous determination of multiple components in formula and preparations of Xiaoyaosan

Haibo Su, Hui Hui, Xiaofen Xu, Ruijing Zhou, Luping Qin & Qiyuan Shan

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Research Article

Article

Lindermyrrhin, a novel 3,4-dihydroisocoumarin from *Lindera myrrha* roots

Thuc-Huy Duong, Van-Kieu Nguyen, Kim-Tuyen Nguyen-Pham, Jirapast Sichaem & Hoang-Dung Nguyen

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Cytotoxic steroidal saponins from the roots and rhizomes of *Maianthemum henryi* ›

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In vitro anti-proliferative and anti-bacterial properties of new C7 benzoate derivatives of pinocembrin

Anna R. Cappello, Francesca Aiello, Nicoletta Polerà, Biagio Armentano, Ivan Casaburi, Maria Luisa Di Gioia, Monica R. Loizzo, Vincenza Dolce, Vincenzo Pezzi & Rosa Tundis

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Article

A new pyrimidine alkaloid from the roots of *Tadehagi triquetrum* (L.) H.Ohashi

Vedpal, Srikanth Jupudi, S. Jubie, N. P. Deepika & S. P. Dhanabal

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Article

Isolation and characterization of a new cytotoxic polyketide–amino acid hybrid from *Thermothelomyces thermophilus* ATCC 42464

Yang-Le Gao, Ming-Liang Zhang, Xue Wang, Huai-Dong Zhang, Jian-Zhong Huang & Li Li

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Cladosporine A, a new indole diterpenoid alkaloid with antimicrobial activities from *Cladosporium* sp. ›

Xue Han, Xue-Feng Bao, Chuan-Xi Wang, Jun Xie, Xiao-Jun Song, Ping Dai, Guo-Dong Chen, Dan Hu, Xin-Sheng Yao & Hao Gao

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Le Ba Vinh, Se Jin Jo, Phong Nguyen Viet, Dan Gao, Kyoung Won Cho, Eun-Jeong Koh, Sung Sun Park, Young Ho Kim & Seo Young Yang

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A new cytotoxic indole alkaloid from *Tabernaemontana inconspicua* stapf

Gertrude Foudjo Melacheu Laura, Emmanuel Mfotie Njoya, Jean-Bosco Jouda, Brussine Nadege Wakeu Kweka, Céline Djama Mbazoa, Fei Wang, Elisabeth Seguin & Jean Wandji

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Calotetrapterins A-C, three new pyranoxanthones and their cytotoxicity from the stem bark of *Calophyllum tetrapterum* Miq

Mulyadi Tanjung, Tjitjik Srie Tjahjandarie, Ratih Dewi Saputri, Baharrani Dwi Kurnia, Muhammad Faisal Rachman & Yana Maolana Syah

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p-Terphenyls and actinomycins from a *Streptomyces* sp. associated with the larva of mud dauber wasp

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Phytochemical and pharmacological profile with biogenetic correlation of bioactive phytoconstituents from the stems of *Cordia sinensis* Lam

Kehkashan Khan, Munawwer Rasheed, Muhammad Nadir, Sadiqa Firdous & Shaheen Faizi

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Toonamicrocarpavarin, a new tirucallane-type triterpenoid from *Toona Ciliata* ›

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Metabolites from the endophytic fungus *colletotrichum* sp. F168 ›

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Piperazic acid containing peptides produced by an endophytic *Streptomyces* sp. isolated from the medicinal plant *Atropa belladonna* ›

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Synthesis and cytotoxic evaluation of usnic acid benzylidene derivatives as potential anticancer agents ›

Van-Kieu Nguyen, Jirapast Sichaem, Huu-Hung Nguyen, Xuan Hieu Nguyen, Thi-Thu-Loi Huynh, Thi-Phuong Nguyen, Nakorn Niamnont, Dinh-Hung Mac, Duc-Dung Pham, Warinthorn Chavasiri, Kim-Phi-Phung Nguyen & Thuc-Huy Duong

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Chemical constituents from *Artemisia rupestris* and their neuraminidase inhibitory activity ›

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Two new terpenoids from the leaves of *callicarpa macrophylla* ›

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Flavonoids from *Artemisia rupestris* and their synergistic antibacterial effects on drug-resistant *Staphylococcus aureus* >

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Chemical composition and anticholinesterase inhibitory activity of the essential oil of *Pseuduvaria macrophylla* (Oliv.) Merr. from Malaysia >

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Cytotoxic phenolic compounds isolated from the fruits of *Macaranga denticulata* ›

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Steroidal glycosides from the underground parts of *Hosta ventricosa* and their anti-inflammatory activities in mice ›

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Aristololactam alkaloids from the roots of *Dasymaschalon rostratum* ›

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Chemical constituents and biological activities of the fruits of *Knema pachycarpa* de Wilde ›

Tran Huu Giap, Phan Minh Duc, Nguyen Van The, Milena Popova, Vassya Bankova, Cao Thi Hue, Vu Thi Kim Oanh, Nguyen Thi Minh Hang, Hung Nguyen Van & Thanh Nguyen Le

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Olea europaea L. Flowers as a new promising anticancer natural product: phenolic composition, antiproliferative activity and apoptosis induction ›

Hanen Essafi Rhouma, Najla Trabelsi, Adele Chimento, Cinzia Benincasa, Amani Tamaalli, Enzo Perri, Mokhtar Zarrouk & Vincenzo Pezzi

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A neglected natural source for targeting glioblastoma

Boris Pejin, Mladen Simonovic, Aleksandra Talevska, Miodrag Glumac, Dimitar Jakimov & Vesna Kojic

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Alkaloids from the root of Indonesian *Annona muricata* L

Ari S. Nugraha, Rachada Haritakun, Jacob M. Lambert, Carolyn T. Dillon & Paul A. Keller

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Article

Abscisic acid identification in Okra, *Abelmoschus esculentus* L. (Moench): perspective nutraceutical use for the treatment of diabetes

Patricia Daliu, Giuseppe Annunziata, Gian Carlo Tenore & Antonello Santini

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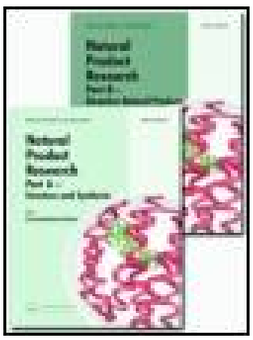

Natural Product Research

Formerly Natural Product Letters

ISSN: 1478-6419 (Print) 1478-6427 (Online) Journal homepage: https://www.tandfonline.com/loi/gnpl20

Calodioscurins A and B, two new isoprenylated xanthones from the stem bark of *Calophyllum dioscurii* P.F. Stevens

Tjitjik Srie Tjahjandarie, Mulyadi Tanjung, Dhaniar Farah Rahmania, Churin In Rhidoma & Ratih Dewi Saputri

To cite this article: Tjitjik Srie Tjahjandarie, Mulyadi Tanjung, Dhaniar Farah Rahmania, Churin In Rhidoma & Ratih Dewi Saputri (2019): Calodioscurins A and B, two new isoprenylated xanthones from the stem bark of *Calophyllum dioscurii* P.F. Stevens, Natural Product Research, DOI: 10.1080/14786419.2019.1643864

To link to this article: https://doi.org/10.1080/14786419.2019.1643864

NATURAL PRODUCT RESEARCH
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Calodioscurins A and B, two new isoprenylated xanthones from the stem bark of *Calophyllum dioscurii* P.F. Stevens

Tjitjik Srie Tjahjandarie, Mulyadi Tanjung, Dhaniar Farah Rahmania, Churin In Rhidoma and Ratih Dewi Saputri

Natural Products Chemistry Research Group, Organic Chemistry Division, Department of Chemistry, Faculty of Science and Technology, Universitas Airlangga, Surabaya, Indonesia

ABSTRACT

Two new isoprenylated xanthones, calodioscurin A (**1**) and B (**2**) were isolated from the stem bark of *Calophyllum dioscurii* P.F. Stevens along with two known isoprenylated 4-phenylcoumarins, apetalolide (**3**) and methyl inophyllum P (**4**). The structures of two new compounds were determined based on their HRESIMS, IR, UV, 1D and 2D NMR spectral data. Compounds **1**–**4** were assayed on P-388 cells, compound **2** showed IC_{50} value 11.5 μM and categorised moderate activity.

ARTICLE HISTORY
Received 11 June 2019
Accepted 4 July 2019

KEYWORDS
Calodioscurins A and B; isoprenylated xanthone; *Calophyllum dioscurii*; P-388 cell

1. Introduction

Calophyllum dioscurii P.F. Stevens (Calophyllaceae) is one species of endemic plant from Indonesia. The decoction of leaves and stem bark of this plant were used to treat fever and skin disease (Heyne 1987). *Calophyllum* plants were known to yield phenolic

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Supplemental data for this article can be accessed at https://doi.org/10.1080/14786419.2019.1643864.

compounds especially isoprenylated benzofurans, isoprenylated xanthones (Tanjung et al. 2018a, 2018b) and isoprenylated 4-phenylcoumarins (Zou et al. 2010). Isoprenylation of xanthones as a major compound on *Calophyllum* genus shows to increase cytotoxic activities toward variety of human cancer cells (Mah et al. 2015). Based on literature study, no isoprenylated xanthone from *C. dioscurii* was reported yet. In continuation of our research on *Calophyllum* plants from Indonesia, two new isoprenylated xanthones (calodiocurins A and B) were isolated from the stem bark of *C. dioscurii*. All of isolated compounds also reported the cytotoxic assayed toward murine leukemia cells P-388.

2. Result and discussion

Calodioscurin A (**1**) showed positive ion peak $[M + H]^+$ at *m/z* 477.2268 corresponding to the molecular formula $C_{29}H_{32}O_6$ based on the information provided at HRESIMS spectrum. Four absorption bands at λ_{max} 217 (3.03), 269 (3.08), 289 (3.20) and 325 (2.81) nm showed that of **1** possesses xanthone chromophore (Ito et al. 2002). The IR spectrum of **1** indicated absorptions for hydroxyl (3411 cm^{-1}), conjugated carbonyl (1649 cm^{-1}), aromatic (1604 and 1579 cm^{-1}) and ether (1159 cm^{-1}) groups. A signal of aromatic in the ^{1}H NMR spectrum of **1** at δ_H 7.58 (H-8) is typical for 1,2,3,4,5,6,7-heptasubstituted xanthone (Iinuma et al. 1997). Additionally, compound **1** showed the proton signals of hydroxyl group, methoxyl group, isoprenyl, and 2,2-dimethylpyrano ring that confirmed by 2D-NMR spectrum. Two signals of hydroxyl group demonstrated at δ_H 13.19 (1-OH), δ_H 5.64 (5-OH), and a methoxyl signal at δ_H 3.99 (6-OCH_3). Furthermore, compound **1** also showed a 2,2-dimethylpyrano ring signal at δ_H 6.74 (1H, d, J = 10.0 Hz, H-4′), 5.60 (1H, d, J = 10.0 Hz, H-3′), 1.48 (6H, s, H-5′/H-6′) as well as two isoprenyl signals at δ_H 5.29 (1H, t, J = 7.2 Hz, H-2′), 5.26 (1H, t, J = 7.6 Hz, H-2′), 3.51 (2H, t, J = 7.2 Hz, H-1′), 3.41 (2H, t, J = 7.6 Hz, H-1′), 1.87 (3H, s, H-5′), 1.76 (3H, s, H-5′), 1.74 (3H, s, H-4′), and 1.71 (3H, s, H-4′). The ^{13}C NMR (APT experiment) spectrum, compound **1** showed the existence of seven methyl carbon signals (including one methoxyl carbon), two methylene carbon signals, five methine carbon signals and 15 quaternary carbon signals (including one carbonyl carbon, one oxycarbon and six oxyaryl carbons). The location of two hydroxyls, a methoxyl, two isoprenyl, and a 2,2-dimethylpyrano ring was established by HMQC and HMBC spectra. A signal of hydroxyl at δ_H 13.19 (1-OH) demonstrated correlation to C-1 (δ_C 156.1), C-2 (δ_C 104.6), C-9a (δ_C 103.3), whilst a vinyl signal of a 2,2-dimethylpyrano ring at δ_H 6.74 (H-4′) correlated to C-3 (δ_C 158.1), C-2′ (δ_C 78.2) and a vinyl signal at δ_H 5.60 (H-3′) correlated to C-2 (δ_C 104.6), C-2′ (δ_C 78.2) showing that 2,2-dimethylpyrano ring fused at C-2 and C-3. The appearance of long-range correlations of a methylen at δ_H 3.51 (H-1′) to C-3 (δ_C 158.1), C-4 (δ_C 107.3), C-4a (154.2), C-2′ (δ_C 122.6), C-3′ (δ_C 131.7), and the signal of a gem dimethyl at δ_H 1.87 (H-5′) and δ_H 1.71 (H-4′) correlated to C-2′ (δ_C 122.6), C-3′ (δ_C 131.7) obviously located the isoprenyl side chain at C-4. A signal of hydroxyl group at δ_H 5.64 (5-OH) showed correlation with three oxyaryl carbons [C-5 (δ_C 137.0), C-6 (δ_C 149.9), C-10a (δ_C 143.3)], and a signal of methoxyl at δ_H 3.99 (6-OCH_3) correlated to C-6 (δ_C 149.9) supported that a hydroxyl attached at C-5 and a methoxyl at C-6. A signal of a methylen at δ_H 3.41 (H-1′) correlated to C-6 (δ_C 149.9), C-7 (δ_C 116.5), C-2′ (δ_C

121.8), C-3′ (δ_C 131.7) indicating that isoprenyl located at C-7. A signal of aromatic at δ_H 7.58 (H-8) correlated to C-6 (δ_C 149.9), C-9 (δ_C 180.9), C-10a (δ_C 143.3), and C-1′ (δ_C 28.5) was supported the location of isoprenyl at C-7. From HRESIMS, 1D and 2D-NMR spectra, compound **1** was established as calodioscurin A.

Calodioscurin B (**2**) was established the molecular formula $C_{28}H_{33}O_5$ deduced from a positive ion peak $[M + H]^+$ at 449.2327 of HRESIMS spectrum. From IR spectrum revealed the presence of hydroxyl (3448 cm^{-1}), conjugated carbonyl (1651 cm^{-1}), aromatic (1627 and 1579 cm^{-1}) and ether (1186 cm^{-1}). Five absorption bands at λ_{max} 217 (3.33), 234 (3.12), 255 (3.02), 263 (2.98) and 299 (2.69) nm, indicated that compound **2** was a typical for a modified xanthone (Ito et al. 2002). The ^{1}H NMR spectrum, compound **2** showed a signal of aromatic at δ_H 6.34 (H-4), and a signal of methylene at δ_H 2.91 (H-5) as well as a methylene splitted into two signals at δ_H 2.88 (H-6a), and δ_H 2.53 (H-6b) confirmed a modified xanthone. Additionally, compound **2** showed signals of two hydroxyl groups, two isoprenyl side chains, and a 2-methyl-1,3-butadienyl side chain that were confirmed by 2D-NMR spectrum. Two hydroxyl signals showed at δ_H 13.27 (1-OH), and δ_H 6.24 (3-OH). Two isoprenyl side chain signals showed two methylene signals at δ_H 3.45 (2H, d, $J = 7.0$ Hz, H-1′), a methylene splitted into two signals [δ_H 3.24 (1H, dd, $J = 8.0$; 14.0 Hz, H-1′a), δ_H 3.04 (1H, dd, $J = 8.0$; 14.0 Hz, H-1′b)]; two vinylic signals [δ_H 5.28 (1H, tm, $J = 7.0$ Hz, H-2′, δ_H 4.68 (1H, tm, $J = 7.9$ Hz, H-2′)], and four methyl signals [δ_H 1.78 (3H, s, H-4′), 1.84 (3H, s, H-5′, δ_H 1.52 (3H, s, H-4′), 1.50 (3H, s, H-5′)]. The presence of 2-methyl-1,3-butadienyl side chain showed two vinylic signals [δ_H 5.81 (1H, dd, $J = 8.0$; 14.0 Hz, H-1′), δ_H 6.06 (1H, dd, $J = 8.0$; 14.0 Hz, H-2′)], a methylene terminal splitted into two signals [δ_H 4.94 (1H, s, H-4′a), δ_H 4.88 (1H, s, H-1′b)] and a methyl signal at δ_H 1.82 (3H, s, H-5′). The ^{13}C NMR spectrum, compound **2** showed 28 carbon signals completely separated. Compound **2** showed 13 carbon signals of a modified xanthone nucleus [δ_C 206.7, δ_C 180.8, δ_C 164.2, δ_C 161.4, δ_C 159.5, δ_C 155.4, δ_C 117.7, δ_C 109.7, δ_C 105.0, δ_C 93.6, δ_C 56.1, δ_C 35.1, δ_C 27.5], 10 carbon signals of two isoprenyl side chains [δ_C 136.5, δ_C 135.2, δ_C 121.1, δ_C 119.5), δ_C 33.1, δ_C 26.1, δ_C 26.0, δ_C 21.6, δ_C 18.0, δ_C 17.9)] and five carbon signals of a 2-methyl-1,3-butadienyl side chain (δ_C 141.4, δ_C 133.6, δ_C 131.3, δ_C 117.5, δ_C 18.7). The placement of two hydroxyl groups, a carbonyl of cyclohexanone, a 2-methyl-1,3-butadienyl side chain, and two isoprenyl side chains on a modified xanthone was confirmed by HMQC and HMBC spectra. A hydroxyl group signal at δ_H 13.27 (1-OH) correlated to C-1 (δ_C 159.5), C-2 (δ_C 109.7), C-9a (δ_C 105.0), and a methylene signal of isoprenyl side chain at δ_H 3.45 (H-1′) showed correlation to C-1 (δ_C 159.5), C-2 (δ_C 109.7), C-3 (δ_C 161.4), C-2′ (δ_C 121.1), C-3′ (δ_C 136.5), consequently an isoprenyl side chain located at C-2. A hydroxyl group signal at δ_H 6.24 (3-OH) correlated to C-3 (δ_C 161.4), and C-4 (δ_C 93.6) indicated that a hydroxyl group placed at C-3. Long-range correlations of a signal of aromatic at δ_H 6.34 (H-4) to C-2 (δ_C 109.7), C-3 (δ_C 161.4), C-4a (δ_C 155.4), C-9a (δ_C 105.0) were confirmed a isoprenyl at C-2 and a hydroxyl at C-3. A methylene of cyclohexanone signal on a modified xanthone at δ_H 2.91 (H-5) showed long-range correlations to C-6 (δ_C 35.1), C-7 (δ_C 206.7), C-8a (δ_C 117.7), and C-10a (δ_C 164.2) indicated that a carbonyl placed at C-7. The methylene signal of another isoprenyl at δ_H 3.24 (H-1′a) and δ_H 3.04 (H-1′b) correlated to carbonyl at C-7 (δ_C 206.7), a quaternary carbon at C-8 (δ_C 56.1), and C-2′ (δ_C 119.5), C-3′ (δ_C 135.2) was assigned the isoprenyl side chain

at C-8. A vinyl signal of 2-methyl-1,3-butadienyl at δ_H 5.81 (H-1′) correlated to quaternary carbon at C-8 (δ_C 56.1), C-3′ (δ_C 141.4), C-4′ (δ_C 117.5), and C-5′ (δ_C 18.7) confirmed a 2-methyl-1,3-butadienyl side chain at C-8. Therefore, the structure of compound **2** was assigned as calodioscurin B.

Two known 4-phenylcoumarins, apetalolide (**3**) and methyl inophyllum P (**4**) from HRESIMS, 1D and 2D-NMR spectra identically with available spectra data (Zou et al. 2010).

Compounds (**1–4**) (Figure 1), the cytotoxic effect against P-388 cells were assessed by MTT method, showing IC_{50} values of 11.5 ± 0.78, 26.38 ± 0.92, 53.9 ± 0.36, and 83.9 ± 1.12 μM, respectively (Tanjung et al. 2018a, 2018b). The structure-activity relationship against P-388 cells of compounds (**1–4**) were discussed based on the type of compounds. Those cytotoxic effects for isoprenylated xanthones (**1**–**2**) more than active compared to isoprenylated 4-phenylcoumarins (**3**–**4**). The cytotoxic effect suggested that compound **2** showed moderate activity, compound **1** displayed weak activity, and compounds (**3**–**4**) were inactive. The structure of **2** is a modified xanthone undergoes a keto-enol tautomerism reaction which is suggested to increase the cytotoxic effect of P-388 cells (Ito et al. 2002).

3. Experimental

3.1. Plant material

Collecting fresh sample of *C. dioscurii* was obtained from the Batam conserved forest, Riau Island, Indonesia on Dec 2015 by Mr. Ismail Rachman. The specimen (CD 00025) was identified in Herbarium Bogoriense, Center of Biological Research and Development, National Institute of Science, Bogor, Indonesia.

3.2. Extraction and isolation

The dried powdered stem bark of *C. dioscurii* (2.1 kg) was extracted with MeOH two times (each 5 L, 3 days) at room temperature. Evaporation of the solvent with rotavapor gave the MeOH extract (430 g). The MeOH extract was suspended in water (9:1 v/v), and then partitioned with *n*-hexane (18 g) and EtOAc (13.5 g) respectively. A part of EtOAc extract (13 g) was chromatographed on polyamide and then eluted with *n*-hexane- EtOAc (from 9:1 to 3:7) to give three fractions. Fraction B (435 g) was chromatographed with the same method and eluted with *n*-hexane- EtOAc (from 9:1 to 4:1) gave four subfractions B_1-B_4. Compound **1** (8 mg) was isolated from subfraction B_2 by radial planar chromatography using *n*-hexane-$CHCl_3$ (from 9:1 to 7:3). Subfraction C (610 mg) was purified by planar radial chromatography using *n*-hexane-acetone (from 19:1 to 4:1) to yield compound **2** (9 mg), compound **3** (11 mg), and compound **4** (7 mg).

3.3. Spectral data

Calodioscurin A (**1**): yellow solid, UV/Vis (MeOH) λ_{max} (nm) (log ε): 217 (3.03), 269 (3.08), 289 (3.20) and 325 (2.81) nm. IR (KBr) ν (cm^{-1}): 3411, 2972, 2925, 2852, 1649,

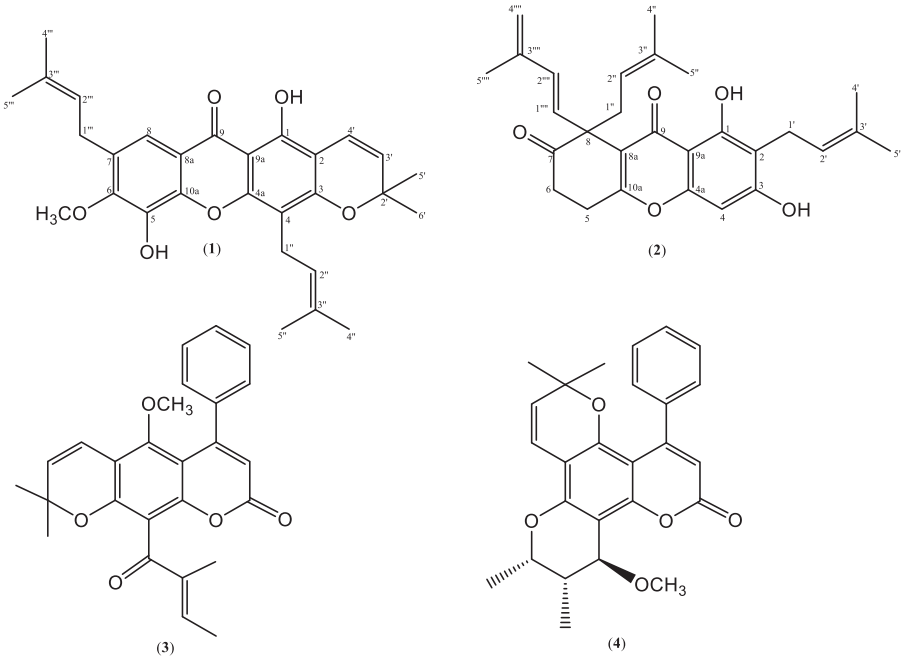

Figure 1. Xanthones and 4-phenylcoumarins from *C. dioscurii*.

1604, 1579 and 1159. ^{1}H-NMR (400 MHz, $CDCl_3$) δ_H ppm: 7.58 (1H, *s*, H-8), 13.19 (1H, *s*, 1-OH), 5.64 (1H, *s*, 5-OH), 3.99 (3H, *s*, 6-OCH_3), 5.60 (1H, *d*, $J = 10.0$ Hz, H-3′), 6.74 (1H, *d*, $J = 10.0$ Hz, H-4′), 1.48 (6H, *s*, H-5′/H-6′), 3.51 (2H, *d*, $J = 7.2$ Hz, H-1″), 5.29 (1H, *d*, $J = 7.2$ Hz, H-2″), 1.71 (3H, *s*, H-4″), 1.87 (3H, *s*, H-5″), 3.41 (2H, *d*, $J = 7.2$ Hz, H-1‴), 5.26 (1H, *d*, $J = 7.6$ Hz, H-2‴), 1.74 (3H, *s*, H-4‴), and 1.76 (3H, *s*, H-5‴). ^{13}C-NMR (100 MHz, $CDCl_3$), δ_C ppm: 156.1 (C-1), 104.6 (C-2), 158.1 (C-3), 107.3 (C-4), 154.2 (C-4a), 137.0 (C-5), 149.9 (C-6), 61.1 (6-OCH_3), 116.5 (C-7), 116.2 (C-8), 120.8 (C-8a), 180.9 (C-9), 103.3 (C-9a), 143.3 (C-10a), 78.2 (C-2′), 127.4 (C-3′), 115.8 (C-4′), 28.4 (C-5′/C-6′), 21.7 (C-1″), 122.6 (C-2″), 131.5 (C-3″), 25.8 (C-4″), 18.0 (C-5″), 28.5 (C-1‴), 121.8 (C-2‴), 131.7 (C-3‴), 25.9 (C-4‴) and 17.9 (C-5‴). HRESIMS: *m/z* $[M + H]^+$ calcd. for $C_{29}H_{33}O_6$ 477.2277, found 477.2268.

Calodioscurin B (**2**): yellow solid, UV/Vis (MeOH) λ_{max} (nm) (log ε): 217 (3.33), 234 (3.12), 255 (3.02), 263 (2.98) and 299 (2.69) nm. IR (KBr) ν (cm^{-1}): 3448, 2966, 2923, 2854, 1651, 1627, 1460, and 1186. ^{1}H-NMR (400 MHz, $CDCl_3$) δ_H ppm: 6.34 (1H, *s*, H-4), 2.91 (2H, *m*, H-5), 2.88 (1H, *m*, H-6a), 2.53 (1H, *m*, H-6b), 13.27 (1H, *s*, 1-OH), 6.24 (1H, *s*, 3-OH), 3.45 (2H, *d*, $J = 7.0$ Hz, H-1′), 5.28 (1H, *d*, $J = 7.0$ Hz, H-2′), 1.78 (3H, *s*, H-4′), 1.84 (3H, *s*, H-5′), 3.24 (1H, *dd*, $J = 8.0$; 14.0 Hz, H-1′a), 3.04 (1H, *dd*, $J = 8.0$; 14.0 Hz, H-1′b), 4.68 (1H, *d*, $J = 7.9$ Hz, H-2′), 1.52 (3H, *s*, H-4′), 1.50 (3H, *s*, H-5′), 5.81 (1H, *d*, $J = 16.0$ Hz, H-1″), 6.06 (1H, *d*, $J = 16.0$ Hz, H-2″), 4.94 (1H, *s*, H-4″a), 4.88 (1H, *s*, H-4″b), and 1.82 (3H, *s*, H-5″). ^{13}C-NMR (100 MHz, $CDCl_3$), δ_C ppm: 159.5 (C-1), 109.7 (C-2), 161.4 (C-3), 93.6 (C-4), 155.4 (C-4a), 27.5 (C-5), 35.1 (C-6), 206.7 (C-7), 56.1 (C-8), 117.7 (C-8a), 180.8 (C-9), 105.0 (C-9a), 164.2 (C-10a), 21.6 (C-1′), 121.1 (C-2′), 136.5 (C-3′), 26.1 (C-4′), 18.0 (C-5′), 33.1 (C-1″), 119.5 (C-2″), 135.2 (C-3″), 26.0 (C-4″), 17.9 (C-5″), 131.3 (C-1‴), 133.6 (C-2‴), 141.4 (C-3‴), 117.5 (C-4‴), and 18.7 (C-5‴). HRESIMS: *m/z* $[M + H]^+$ calcd. for $C_{28}H_{33}O_5$ 449.2328, found 449.2327.

3.4. Cytotoxic assay

Effect of compounds (**1**–**4**) against P-388 cells (human murine leukaemia) were evaluated in pursuance of the MTT colorimetric method as anteriorly described (Saputri et al. 2018).

4. Conclusions

In this research, two new isoprenylated xanthones, calodioscurin A (**1**) and B (**2**) were found the first time on natural compounds from the stem bark of *C. dioscurii*.

Disclosure statement

No conflict of interest on author's team.

Funding

This research was supported by Research Grant of Universitas Airlangga, Indonesia (Penelitian Hibah Mandat, Universitas Airlangga, 2019).

References

Heyne K. 1987. The useful Indonesian plants. Jakarta (Indonesia): Research and Development Agency, Ministry of Forestry.

Iinuma M, Ito T, Tosa H, Tanaka T, Miyake R, Chelladurai V. 1997. Prenylated xanthonoids from *Calophyllum apetalum*. Phytochem. 46(8):1423–1429.

Ito C, Itoigawa M, Mishina Y, Filho VC, Mukainaka T, Tokuda H, Nishino H, Furukawa H. 2002. Chemical constituents of *Calophyllum brasiliensis*: structure elucidation of seven xanthones and their cancer chemopreventive activity. J Nat Prod. 65(3):267–272.

Mah SH, Ee GCL, Teh SS, Sukari MA. 2015. *Calophyllum inophyllum* and *Calophyllum soulattri* source of anti-proliferative xanthones and their structure-activity relationships. Nat Prod Res. 29(1):98–101.

Saputri RD, Tjahjandarie TS, Tanjung M. 2018. Meliglabrin, a new flavonol derivative from the leaves of *Melicope glabra* (Blume) T.G. Hartley. Nat Prod Sci. 24(3):155–158.

Tanjung M, Rachmadiarti F, Prameswari A, Agyani VUW, Saputri RD, Tjahjandarie TS, Syah YM. 2018a. Airlanggins A-B, two new isoprenylated benzofuran-3-ones from the stem bark of *Calophyllum soulattri*. Nat Prod Res. 32(13):1493–1498.

Tanjung M, Rachmadiarti F, Saputri RD, Tjahjandarie TS. 2018b. Mesuacalophylloidin, a new isoprenylated 4-phenylcoumarin from *Mesua calophylloides* (Ridl.) Kosterm. Nat Prod Res. 32(9): 1062–1067.

Zou J, Wu J, Liu S-Z, Zhao WM. 2010. New coumarins and triterpenes from *Calophyllum inophyllum*. Helv Chim Acta. 93(9):1812–1821.