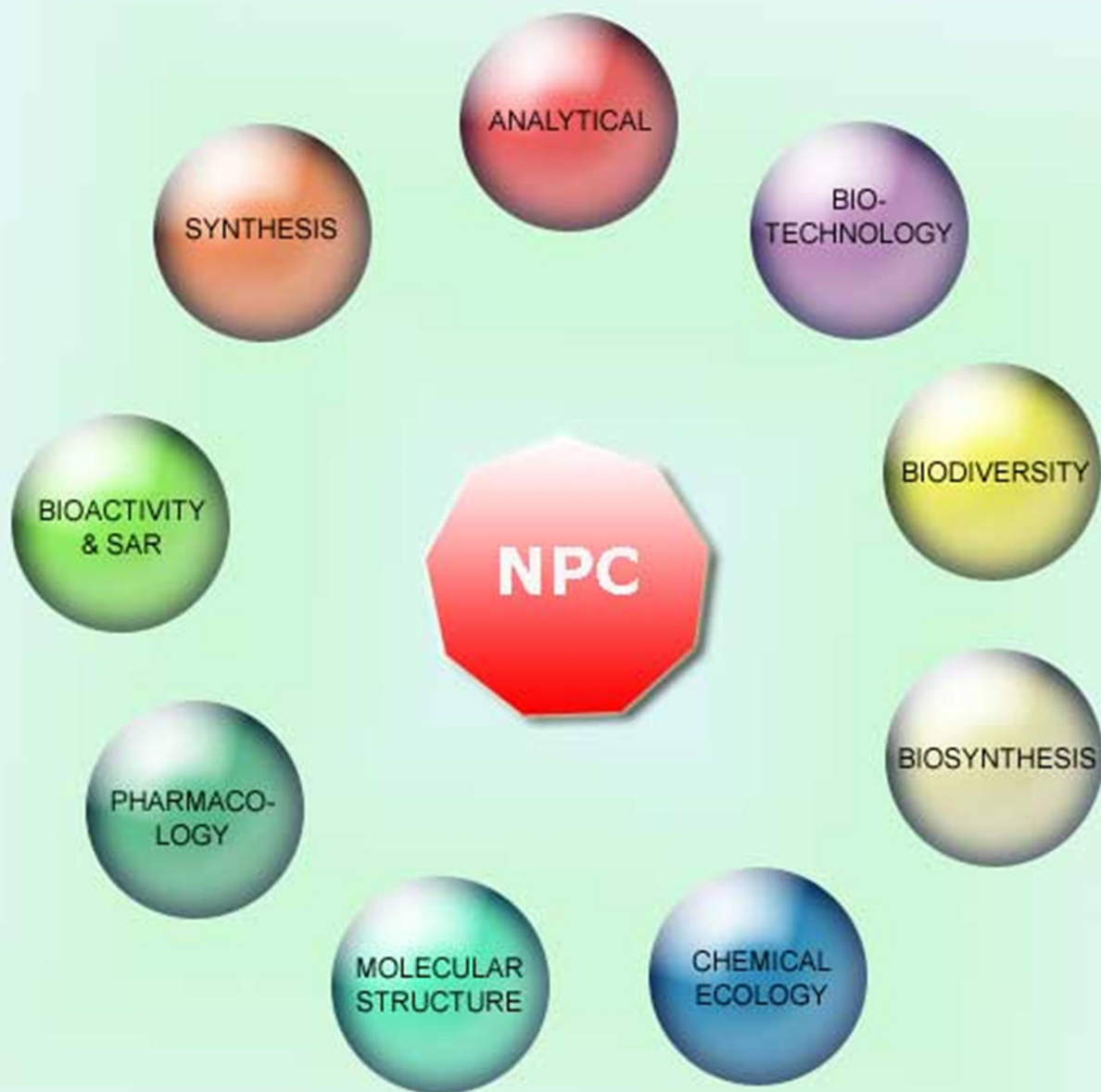


NATURAL PRODUCT COMMUNICATIONS

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
mimaki@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. Koobanally
Durban, South Africa

Prof. Karsten Krohn
Paderborn, Germany

Prof. Chiaki Kuroda
Tokyo, Japan

Prof. Hartmut Laatsch
Göttingen, Germany

Prof. Marie Lacaille-Dubois
Dijon, France

Prof. Shoen-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.

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^a, Carla Cicala^a, Giulia Musciacco^a, Vincenzo De Feo^b, Anibal G. Amat^{c,†},
Armando Ialenti^a and Nicola Mascolo^{a*}

^aDipartimento di Farmacia, Università di Napoli Federico II, Via D. Montesano 49, 80131 Napoli, Italy

^bDipartimento di Scienze Farmaceutiche e Biomediche, Università degli Studi di Salerno, Via Ponte don Melillo, 84084, Fisciano (Salerno), Italy

^cFacultad de Ciencias Exactas, Químicas y Naturales, Universidad Nacional de Misiones, Felix de Azara 1552, 3300 Posadas, Misiones, Argentina

nicola.mascolo@unina.it

Received: December 4th, 2012; Accepted: February 14th, 2013

Numerous studies support the cardiovascular effects of medicinal plants. This review examines plants whose antihypertensive and vasorelaxant effects have been scientifically validated. Our study selected only chemically characterized plants whose mode of action had already been investigated. The aim of the paper is to provide a quick way to identify medicinal plants and their constituents with antihypertensive and vasorelaxant activities.

Keywords: Phenols, Alkaloids, Terpenes, Hypertension, Cardiovascular diseases, Drug discovery.

Hypertension is the most prevalent cardiovascular disease and is a leading cause of morbidity and mortality being, also, an important risk factor for the development of other cardiovascular disturbances [1]. The control of hypertension becomes imperative and conventional drug therapy demands, in most cases, the use of multiple drugs, often not devoid of side effects. It becomes, therefore, an urgent necessity to search for new drugs that possess the same therapeutic efficacy and which are contextually free of side effects. Medicinal plants are the major source of new compounds.

Despite the fact that many plants have been screened for their antihypertensive/vasorelaxant effect, only a small percentage has been chemically investigated and studied as potential therapeutic agents in the management of hypertension and its related complications.

Identification of plant active components and the understanding of their mode of action are crucial steps in the process of drug discovery [2].

The possibility of identifying new, potentially useful compounds from the plant kingdom is very high if the fact that only a small proportion (about 10%) of plants that has been biologically screened is also taken into consideration [3].

The aim of this review is to provide a concise discussion, by means of three summary Tables, that will help investigators to identify quickly medicinal plants with antihypertensive/vasorelaxant activities, their major constituents, and the mechanism underlying their effects.

Our review results (Tables 1-3) refer to a restricted number of medicinal plants whose antihypertensive/vasorelaxant effects have been scientifically validated. They belong to a broad spectrum of plant families used in folk medicine worldwide. Here we report 61 plants belonging to 57 genera in 36 families.

Compounds with different structures, but with the same antihypertensive activity, have been isolated from the above mentioned medicinal plants and studied, *in vivo* and *in vitro*, against experimentally induced hypertension and/or on isolated vessel tissues: 31 (50.8%) and 14 (22.9%) are studies reporting experiments conducted *in vitro* or *in vivo*, respectively and 16 (26.2%) are those undertaken both *in vitro* and *in vivo*.

Tables 1-3 also provide a chemical library of molecules of some interest. Phenols are pointed out as major constituents, followed by alkaloids and terpenes. All these active ingredients are the main compounds in medicinal plants with antihypertensive/vasorelaxant action. Their antihypertensive effects have been attributed to the involvement of K⁺ and Ca²⁺-channels, adenilate cyclase, nitric oxide (NO) and adrenergic system (α - and β -receptor), angiotensin converting enzyme (ACE), serotonin (5HT), norepinephrine (NE), prostaglandins (PGs)- pathway, phosphodiesterase enzyme (PDE) and Na⁺absorption. Among the compounds reported, terpenoids seem to be promising drug candidates or lead compounds for the development of novel therapeutic agents [45]. They include a wide range of di- tri-, sesqui- and tetraterpenoids, most of which have been investigated for their pharmacological activities.

Stevioside, from *Stevia rebaudiana* (Table 3), is an example of a diterpenoid glycoside, studied *in vivo* and *in vitro*, with a potential use in hypertension due to its capability to induce diuresis and a

[†]Anibal G. Amat passed away and this paper is dedicated to his memory.

Table 1: Plants containing phenols as active constituents

(All acronyms and abbreviations in tables 1-3 are reported in the text)

Plant/ botanical name	Family name	Chemical constituent(s)	Studies <i>in vitro/in vivo</i>	Mode of action	Reference
<i>Acer nikoense</i> (Miq.) Maxim.	Aceraceae	scopoletin cleomiscosin A aquillochin	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[4]
<i>Achillea millefolium</i> L.	Asteraceae	artemetin	<i>in vivo</i>	ACE-inhibitor	[5]
<i>Agastache Mexicana</i> (Kunth) Lint & Epling	Lamiaceae	tilianin	<i>in vitro</i>	NO release and K ⁺ channels modulator	[6]
<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	apigenin luteolin kaempferol quercetin	<i>in vivo</i>	ACE-inhibitor	[7-10]
<i>Angelica keiskei</i> Koidz.	Apiaceae	xanthoangelol hydroxyderricin	<i>in vitro/in vivo</i>	PDE-inhibitor	[11,12]
<i>Calycotome villosa</i> Link	Fabaceae	chrysin	<i>in vitro/in vivo</i>	NO release	[13]
<i>Cnidium monnieri</i> (L.) Cusson	Apiaceae	osthole	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[14]
<i>Citrus sinensis</i> Osbeck	Rutaceae	hesperetin	<i>in vitro</i>	PDE-inhibitor	[15]
<i>Cistanche tubulosa</i> Wight	Scrophulariaceae	kankanoside F kankanose echinacoside acteoside cistanoside F	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[16,17]
<i>Clerodendron trichotomum</i> Thunb.	Lamiaceae	acteoside leucosceptoside martynoside	<i>in vitro</i>	ACE-inhibitor	[18]
<i>Cuscuta japonica</i> Choisy	Cuscutaceae	caffeoylquinic acid	<i>in vivo</i>	ACE-inhibitor	[19,20]
<i>Daucus carota</i> L.	Apiaceae	coumarin glycosides	<i>in vitro /in vivo</i>	Ca ²⁺ -channel antagonist	[21]
<i>Dioclea grandiflora</i> Mart. ex Benth.	Leguminosae	dioclein	<i>in vitro/in vivo</i>	Ca ²⁺ antagonist and K ⁺ - channel modulator	[22,23]
<i>Diospyros kaki</i> Thunb.	Ebenaceae	astragalin isoquercitrin quercetin	<i>in vitro</i>	ACE-inhibitor	[24]
<i>Erythroxylum gonocladum</i> O.E. Schulz	Erythroxylaceae	astilbin	<i>in vitro</i>	ACE-inhibitor	[25]
<i>Euphoria longana</i> Lam.	Sapindaceae	corilagin	<i>in vivo</i>	reduced NE and NO release	[26]
<i>Gentiana kochiana</i> E.P.Perrier & Sonjeon	Gentianaceae	gentiacaulein gentiakoichianin butein	<i>in vitro/in vivo</i>	ACE-inhibitor	[27,28]
<i>Geum japonicum</i> Thunb.	Rosaceae	penta- <i>O</i> -galloyl- β -glucoside, casuarinin and 5-desgalloylstachyurin	<i>in vitro</i>	NO release	[29]
<i>Guazuma ulmifolia</i> Lam.	Sterculiaceae	procyanidin	<i>in vivo</i>	NO release	[30]
<i>Hibiscus sabdariffa</i> Rottler	Malvaceae	cyanidin/delphinidin-3- <i>O</i> -sambubioside	<i>In vitro</i>	ACE-inhibitor	[31]
<i>Lepechinia caulescens</i> (Ortega) Epling	Lamiaceae	ursolic acid	<i>in vitro</i>	NO release	[32]
<i>Ligusticum wallichii</i> Franch.	Apiaceae	tetramethylpyrazine	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[33]
<i>Ligustrum purpurascens</i> Yang	Oleaceae	acteoside leucosceptoside A martynoside	<i>in vitro</i>	Ca ²⁺ -channel antagonist and ACE-inhibitor	[24]
<i>Lindera megaphylla</i> Hemsl.	Lauraceae	dicentrine	<i>in vivo</i>	α_1 - antagonist	[34]
<i>Paeonia moutan</i> Sims	Paeoniaceae	tetragalloylglucose pentagalloylglucose	<i>in vitro</i>	NO release	[35]
<i>Phyllanthus niruri</i> L.	Euphorbiaceae	methyl brevifolincarboxylate	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[36]
<i>Phyllanthus urinaria</i> L.	Euphorbiaceae	geraniin	<i>in vitro/in vivo</i>	ACE inhibitor	[37]
<i>Salvia miltiorrhiza</i> Bunge	Lamiaceae	salvianolic acid B lithospermic acid	<i>in vitro/in vivo</i>	Ca ²⁺ -channel antagonist and ACE- inhibitor	[38-40]
<i>Sedum sarmentosum</i> Bunge	Crassulaceae	quercetin	<i>in vitro</i>	ACE-inhibitor	[41]
<i>Selaginella tamariscina</i> L.	Selaginellaceae	amentoflavone	<i>In vitro</i>	Ca ²⁺ -channel antagonist	[42]
<i>Tropaeolum majus</i> L.	Tropaeolaceae	isoquercitrin kaempferol	<i>in vivo</i>	ACE inhibitor	[43]
<i>Zingiber officinale</i> Roscoe	Zingiberaceae	gingerol shogaol zingerone paradol	<i>in vitro/in vivo</i>	Ca ²⁺ -channel antagonist	[44]

strong decrease in arterial pressure and heart rate in a dose-dependant fashion by acting on multiple targets such as the Ca²⁺-channel, prostaglandins pathway and Na⁺ absorption. Stevioside tested in humans was shown to be safe and effective in lowering blood pressure [46].

Concluding remarks

Since ancient times, plants have been used as medicines. Today, about 25% of the effective drugs in use are of natural origin [84]. Currently, throughout the world the development of new drugs seems to be slowing down despite large investments in research and

development. Novel drugs can and must be useful in therapy. It is, indeed, expected that for a given disease a new drug should lead to a substantial improvement in comparison with drugs already in use. For this reason, it is necessary to return to plants as an inexhaustible source of substances that are interesting in both the chemical and pharmacological fields. Natural products are great tools for identifying novel structures as therapeutic agents in a drug discovery process that begins and ends in humans. We hope that this review may inspire new developments in organic chemistry in order to create analogues of the original lead compounds with improved pharmacological and/or pharmaceutical properties.

Table 2: Plants containing alkaloids as active constituents.

Species	Family name	Chemical constituent(s)	Studies <i>in vitro/in vivo</i>	Mode of action	Reference
<i>Annona cherimolia</i> Mill.	Annonaceae	anonaine roemerine pukateine	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[47,48]
<i>Cassytha filiformis</i> L.	Lauraceae	ocoteine	<i>in vitro</i>	α ₁ -antagonist	[49]
<i>Corydalis racemosa</i> Pers.	Fumariaceae	tetrahydropalmatine	<i>in vivo</i>	decreased 5-HT release in hypothalamus	[50,51]
<i>Evodia rutaecarpa</i> L.	Rutaceae	rutaecarpine	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[52,53]
<i>Fritillaria usuriensis</i> Maxim.	Liliaceae	peimisine verticine verticinone	<i>in vitro</i>	ACE-inhibitor	[54]
<i>Illigera luzonensis</i> Merr.	Hernandia-ceae	<i>n</i> -methyl-actinodaphnine	<i>in vitro</i>	α ₁ -antagonist	[55]
<i>Ligusticum wallichii</i> Franch.	Apiaceae	tetramethylpirazine	<i>in vivo</i>	K ⁺ -channel modulator	[56]
<i>Lindera megaphylla</i> Hemsl.	Lauraceae	dicentrine	<i>in vivo</i>	α ₁ -antagonist	[57]
<i>Magnolia fargesii</i> (Finet & Gagnep.) W. C. Cheng	Magnoliaceae	denudatin B	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[58]
<i>Mahonia aquifolium</i> Nutt.	Berberidaceae	berbamine oxyacanthine	<i>in vitro</i>	α ₁ and Ca ²⁺ -channel antagonist	[59]
<i>Platycapnos spicatus</i> Bernh.	Papaveraceae	nantenine domesticine nantenine	<i>in vitro</i> <i>in vivo</i>	α ₁ -antagonist Ca ²⁺ -channel antagonist	[24]
<i>Stephania glabra</i> Miers	Menispermaceae	cycleanine	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[24]
<i>Stephania tetrandra</i> S. Moore	Menispermaceae	tetrandrine	<i>in vivo</i>	Ca ²⁺ -channel antagonist	[60,61]
<i>Uncaria rhynchophylla</i> Miq.	Rubiaceae	hirsutine rhynchophylline	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[62]
<i>Verbesina caracasana</i> B. L. Rob. & Greenm.	Asteraceae	leonurine caracasandiamide	<i>in vitro/in vivo</i>	Ca ²⁺ -channel antagonist	[63,64]

Table 3: Plants containing terpenes as active constituents.

Species	Family name	Chemical constituent(s)	Studies <i>in vitro/in vivo</i>	Mode of action	Reference
<i>Aegle marmelos</i> Correa	Rutaceae	auraptene	<i>in vivo</i>	Ca ²⁺ -channel antagonist	[65]
<i>Alepidea amarymbica</i> Eckl. & Zeyh.	Apiaceae	kaurenoids	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[66]
<i>Andrographis paniculata</i> Nees	Acanthaceae	14-deoxy-11,12-didehydroandrographolide	<i>in vivo</i>	Non selective β- antagonist and ACE-inhibitor	[67]
<i>Coleus forskohlii</i> Briq.	Lamiaceae	forskolin coleonol	<i>in vitro/in vivo</i>	Adenilate Cyclase Activator	[68]
<i>Croton cajucara</i> Benth.	Euphorbiaceae	<i>trans</i> -dehydrocrotonin	<i>in vitro/in vivo</i>	Ca ²⁺ -channel antagonist and NO release	[5,69]
<i>Marrubium vulgare</i> L.	Lamiaceae	marrubenol	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[70]
<i>Mentha villosa</i> Huds.	Lamiaceae	rotundifolone	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[71]
<i>Moldenhawera nutans</i> L.P. Queiroz, G.P. Lewis & Allkin	Caesalpinia-ceae	labd-8 (17)-en-15-oic acid	<i>in vitro/in vivo</i>	Non selective β- antagonist	[72]
<i>Ocimum gratissimum</i> L.	Lamiaceae	eugenol	<i>in vitro/in vivo</i>	Non selective β-antagonist	[73-75]
<i>Petasites formosanus</i> Kitam.	Asteraceae	ilso-S-petasin	<i>in vitro</i>	Ca ²⁺ -channel antagonist	[76]
<i>Polyalthia longifolia</i> (Sonn.) Hook. f. & Thomson	Annonaceae	kovalenic acid	<i>in vitro/in vivo</i>	NO release	[68]
<i>Stevia rebaudiana</i> Bertoni	Asteraceae	stevioside	<i>in vitro/in vivo</i>	Ca ²⁺ -channel antagonist PG's pathway Na ⁺ absorption	[46,77-80]
<i>Viguiera arenaria</i> Baker	Asteraceae	ent-pimara-8(14),15-dien-19-oic acid	<i>in vitro</i>	α ₁ /Ca ²⁺ -channel antagonist	[81,82]
<i>Xylopiia aethiopica</i> A. Rich	Annonaceae	kaurenoids	<i>in vivo</i>	Ca ²⁺ -channel antagonist	[83]

References

- [1] Mascolo N, Borrelli F, Capasso R, Capasso F, Di Carlo G, Izzo AA, Pinto L, Castaldo S, Longo R (1998) Natural products and cardiovascular disturbances. *Phytotherapy Research*, **12**, 121-123.
- [2] Harvey AL. (2008) Natural products in drug discovery. *Drug Discovery Today*, **19-20**, 894-901.
- [3] Capasso F, De Pasquale R, Grandolini G, Mascolo N. (Eds) (2000) In *Farmacognosia*, Springer-Verlag, Italy, Milano. 1-189.
- [4] Iizuka T, Nagumo S, Yotsumoto H, Moriyama H, Nagai M. (2007) Vasorelaxant effects of *Acer nikoense* extract and isolated coumarinolignans on rat aortic rings. *Biological and Pharmaceutical Bulletin*, **6**, 1164-1166.
- [5] de Souza P, Gasparotto A Jr, Crestani S, Stefanello ME, Marques MC, da Silva-Santos JE, Kassuya CA. (2011) Hypotensive mechanism of the extracts and artemetin isolated from *Achillea millefolium* L. (Asteraceae) in rats. *Phytomedicine*, **10**, 819-825.
- [6] Hernández-Abreu O, Castillo-España P, León-Rivera I, Ibarra-Barajas M, Villalobos-Molina R, González-Christen J, Vergara-Galicia J, Estrada-Soto S. (2009) Antihypertensive and vasorelaxant effects of tilianin isolated from *Agastache mexicana* are mediated by NO/cGMP pathway and potassium channel opening. *Biochemical Pharmacology*, **1**, 54-61.
- [7] Kim TJ, Kim JH, Jin YR, Yun YP. (2006) The inhibitory effect and mechanism of luteolin-7-glucoside on rat aortic vascular smooth muscle cell proliferation. *Archive of Pharmacal Research*, **1**, 67-72.

- [8] Sanchez M, Lodi F, Vera R, Villar IC, Cogolludo A, Jimenez R, Moreno L, Romero M, Tamargo J, Perez-Vizcaino F, Duarte J. (2007) Quercetin and isorhamnetin prevent endothelial dysfunction, superoxide production, and overexpression of p47phox induced by angiotensin II in rat aorta. *Journal of Nutrition*, **4**, 910-915.
- [9] Loizzo MR, Said A, Tundis R, Rashed K, Statti GA, Hufner A, Menichini F. (2007) Inhibition of angiotensin converting enzyme (ACE) by flavonoids isolated from *Ailanthus excelsa* (Roxb) (Simaroubaceae). *Phytotherapy Research*, **1**, 32-36.
- [10] Rodrigo R, Gil D, Miranda-Merchak A, Kalantzidis G. (2012) Antihypertensive role of polyphenols. *Advances in Clinical Chemistry*, **58**, 225-254.
- [11] Matsuura M, Kimura Y, Nakata K, Baba K, Okuda H. (2001) Artery relaxation by chalcones isolated from the roots of *Angelica keiskei*. *Planta Medica*, **3**, 230-235.
- [12] Ogawa H, Ohno M, Baba K. (2005) Hypotensive and lipid regulatory actions of 4-hydroxyderricin, a chalcone from *Angelica keiskei*, in stroke-prone spontaneously hypertensive rats. *Clinical and Experimental Pharmacology and Physiology*, **1-2**, 19-23.
- [13] Cherkaoui-Tangi K, Lachkar M, Wibo M, Morel N, Gilani AH, Lyoussi B. (2008) Pharmacological studies on hypotensive, diuretic and vasodilator activities of chrysin glucoside from *Calycotome villosa* in rats. *Phytotherapy Research*, **3**, 356-361.
- [14] Fusi F, Sgaragli G, Hale M, Cuong NM, Saponara S. (2012) Mechanism of osthole inhibition of vascular Ca(v)1.2 current. *European Journal of Pharmacology*, **1-3**, 22-27.
- [15] Orallo F, Alvarez E, Basaran H, Lugnier C. (2004) Comparative study of the vasorelaxant activity, superoxide-scavenging ability and cyclic nucleotide phosphodiesterase-inhibitory effects of hesperetin and hesperidin. *Naunyn Schmiedeberg's Archives of Pharmacology*, **6**, 452-463.
- [16] Yoshikawa M, Matsuda H, Morikawa T, Xie H, Nakamura S, Muraoka O. (2006) Phenylethanoid oligoglycosides and acylated oligosugars with vasorelaxant activity from *Cistanche tubulosa*. *Bioorganic & Medicinal Chemistry*, **22**, 7468-7475.
- [17] Xie H, Morikawa T, Matsuda H, Nakamura S, Muraoka O, Yoshikawa M. (2006) Monoterpene constituents from *Cistanche tubulosa*--chemical structures of kankanosides A-E and kankanol. *Chemical and Pharmaceutical Bulletin*, **5**, 669-675.
- [18] Kang DG, Lee YS, Kim HJ, Lee YM, Lee HS. (2003) Angiotensin converting enzyme inhibitory phenylpropanoid glycosides from *Clerodendron trichotomum*. *Journal of Ethnopharmacology*, **1**, 151-154.
- [19] Liu JC, Hsu FL, Tsai JC, Chan P, Liu JY, Thomas GN, Tomlinson B, Lo MY, Lin JY. (2003) Antihypertensive effects of tannins isolated from traditional Chinese herbs as non-specific inhibitors of angiotensin converting enzyme. *Life Sciences*, **12**, 1543-1555.
- [20] Mishima S, Yoshida C, Akino S, Sakamoto T. (2005) Antihypertensive effects of Brazilian propolis: identification of caffeoylquinic acids as constituents involved in the hypotension in spontaneously hypertensive rats. *Biological and Pharmaceutical Bulletin*, **10**, 1909-1914.
- [21] Gilani AH, Shaheen E, Saeed SA, Bibi S, Irfanullah, Sadiq M, Faizi S. (2000) Hypotensive action of coumarin glycosides from *Daucus carota*. *Phytomedicine*, **7**, 423-426.
- [22] Trigueiro F, Cortes SF, Almeida RN, Lemos VS. (2000) Endothelium-independent vasorelaxant effect of dioclein, a new flavonoid isolated from *Dioclea grandiflora*, in the rat aorta. *Journal of Pharmacy and Pharmacology*, **11**, 1431-1434.
- [23] Côrtes SF, Rezende BA, Corriu C, Medeiros IA, Teixeira MM, Lopes MJ, Lemos VS. (2001) Pharmacological evidence for the activation of potassium channels as the mechanism involved in the hypotensive and vasorelaxant effect of dioclein in rat small resistance arteries. *British Journal of Pharmacology*, **6**, 849-858.
- [24] Loizzo MR, Tundis R, Menichini F, Statti GA, Menichini F. (2008) Hypotensive natural products: current status. *Mini Review in Medicinal Chemistry*, **8**, 828-855.
- [25] Lucas-Filho MD, Silva GC, Cortes SF, Mares-Guia TR, Perpétua Ferraz V, Serra CP, Braga FC. (2010) ACE inhibition by astilbin isolated from *Erythroxylum gonocladum* (Mart.) O.E. Schulz. *Phytomedicine*, **5**, 383-387.
- [26] Cheng JT, Lin TC, Hsu FL. (1995) Antihypertensive effect of corilagin in the rat. *Canadian Journal of Physiology and Pharmacology*, **73**, 1425-1429.
- [27] Chericoni S, Testai L, Calderone V, Flamini G, Nieri P, Morelli I, Martinotti E. (2003) The xanthenes gentiacaulein and gentiokochianin are responsible for the vasodilator action of the roots of *Gentiana kochiana*. *Planta Medica*, **8**, 770-772.
- [28] Kang DG, Kim YC, Sohn EJ, Lee YM, Lee AS, Yin MH, Lee HS. (2003) Hypotensive effect of butein via the inhibition of angiotensin converting enzyme. *Biological and Pharmaceutical Bulletin*, **9**, 1345-1347.
- [29] Xie YW, Xu HX, Dong H, Fiscus RR, But PP. (2007) Role of nitric oxide in the vasorelaxant and hypotensive effects of extracts and purified tannins from *Geum japonicum*. *Journal of Ethnopharmacology*, **1**, 128-133.
- [30] Magos GA, Mateos JC, Páez E, Fernández G, Lobato C, Márquez C, Enriquez RG. (2008) Hypotensive and vasorelaxant effects of the procyanidin fraction from *Guazuma ulmifolia* bark in normotensive and hypertensive rats. *Journal of Ethnopharmacology*, **1**, 58-68.
- [31] Ojeda D, Jiménez-Ferrer E, Zamilpa A, Herrera-Arellano A, Tortoriello J, Alvarez L. (2010) Inhibition of angiotensin convertin enzyme (ACE) activity by the anthocyanins delphinidin- and cyanidin-3-O-sambubiosides from *Hibiscus sabdariffa*. *Journal of Ethnopharmacology*, **1**, 7-10.
- [32] Aguirre-Crespo F, Vergara-Galicia J, Villalobos-Molina R, Javier López-Guerrero J, Navarrete-Vázquez G, Estrada-Soto S. (2006) Ursolic acid mediates the vasorelaxant activity of *Lepechinia caulescens* via NO release in isolated rat thoracic aorta. *Life Sciences*, **11**, 1062-1068.
- [33] Pang PK, Shan JJ, Chiu KW. (1996) Tetramethylpyrazine, a calcium antagonist. *Planta Medica*, **5**, 431-435.
- [34] Yu SM, Hsu SY, Ko FN, Chen CC, Huang YL, Huang TF, Teng CM. (1992) Haemodynamic effects of dicentrine, a novel alpha 1-adrenoceptor antagonist: comparison with prazosin in spontaneously hypertensive and normotensive Wistar-Kyoto rats. *British Journal of Pharmacology*, **4**, 797-801.
- [35] Yoo MY, Lee BH, Choi YH, Lee JW, Seo JH, Oh KS, Koo HN, Seo HW, Yon GH, Kwon DY, Kim YS, Ryu SY (2006) Vasorelaxant effect of the root bark extract of *Paeonia moutan* on isolated rat thoracic aorta. *Planta Medica*, **14**, 1338-1341.
- [36] Iizuka T, Moriyama H, Nagai M. (2006) Vasorelaxant effects of methyl brevifolinicarbonylate from the leaves of *Phyllanthus niruri*. *Biological and Pharmaceutical Bulletin*, **1**, 177-179.
- [37] Lin SY, Wang CC, Lu YL, Wu WC, Hou WC. (2008) Antioxidant, anti-semicarbazide-sensitive amine oxidase, and anti-hypertensive activities of geraniin isolated from *Phyllanthus urinaria*. *Food and Chemical Toxicology*, **7**, 2485-2492.
- [38] Gao XP, Xu DY, Deng YL, Zhang Y. (2004) Screening of angiotensin converting enzyme inhibitors from *Salvia miltiorrhizae*. *Zhongguo Zhong Yao Za Zhi*, **4**, 359-362.
- [39] Nagai M, Noguchi M, Iizuka T, Otani K, Kamata K. (1996) Vasodilator effects of des(alpha-carboxy-3,4-dihydroxyphenethyl)lithospermic acid (8-epiblechnic acid), a derivative of lithospermic acids in *Salvia miltiorrhizae* radix. *Biological and Pharmaceutical Bulletin*, **2**, 228-232.
- [40] Wang W, Hu GY, Wang YP. (2006) Selective modulation of L-type calcium current by magnesium lithospermate B in guinea-pig ventricular myocytes. *Life Sciences*, **26**, 2989-2997.
- [41] Oh H, Kang DG, Kwon JW, Kwon TO, Lee SY, Lee DB, Lee HS. (2004) Isolation of angiotensin converting enzyme (ACE) inhibitory flavonoids from *Sedum sarmentosum*. *Biological and Pharmaceutical Bulletin*, **12**, 2035-2037.
- [42] Kang DG, Yin MH, Oh H, Lee DH, Lee HS. (2004) Vasorelaxation by amentoflavone isolated from *Selaginella tamariscina*. *Planta Medica*, **8**, 718-722.

- [43] Gasparotto Junior A, Gasparotto FM, Lourenço EL, Crestani S, Stefanello ME, Salvador MJ, da Silva-Santos JE, Marques MC, Kassuya CA. (2011) Antihypertensive effects of isoquercitrin and extracts from *Tropaeolum majus* L.: evidence for the inhibition of angiotensin converting enzyme. *Journal of Ethnopharmacology*, **2**, 363-372.
- [44] Tabassum N, Ahmad F. (2011) Role of natural herbs in the treatment of hypertension. *Pharmacognosy Reviews*, **9**, 30-40.
- [45] Tirapelli CR, Ambrosio SR, da Costa FB, de Oliveira AM. (2008) Diterpenes: a therapeutic promise for cardiovascular diseases. *Recent Patents on Cardiovascular Drug Discovery*, **1**, 1-8.
- [46] Hsieh MH, Chan P, Sue YM, Liu JC, Liang TH, Huang TY, Tomlinson B, Sun Chow MS, Kao PF, Chen YJ. (2003) Efficacy and tolerability of oral stevioside in patients with mild essential hypertension: a two-year, randomized, placebo-controlled study. *Clinical Therapeutics*, **11**, 2797-2808.
- [47] Chuliá S, Ivorra MD, Cavé A, Cortés D, Noguera MA, D'Ocón MP. (1995) Relaxant activity of three aporphine alkaloids from *Annona cherimolia* on isolated aorta of rat. *Journal of Pharmacy and Pharmacology*, **8**, 647-650.
- [48] Valiente M, D'Ocon P, Noguera MA, Cassels BK, Lugnier C, Ivorra MD. (2004) Vascular activity of (-)-anonaine, (-)-roemerine and (-)-pukateine, three natural 6a(R)-1,2-methylenedioxyaporphines with different affinities for alpha1-adrenoceptor subtypes. *Planta Medica*, **7**, 603-609.
- [49] Chang CW, Ko FN, Su MJ, Wu YC, Teng CM. (1997) Pharmacological evaluation of ocoetine, isolated from *Cassytha filiformis*, as an alpha 1-adrenoceptor antagonist in rat thoracic aorta. *Japanese Journal of Pharmacology*, **3**, 207-214.
- [50] Chueh FY, Hsieh MT, Chen CF, Lin MT. (1995) Hypotensive and bradycardic effects of dl-tetrahydropalmatine mediated by decrease in hypothalamic serotonin release in the rat. *Japanese Journal of Pharmacology*, **2**, 177-180.
- [51] Lin MT, Chueh FY, Hsieh MT, Chen CF. (1996) Antihypertensive effect of DL-tetrahydropalmatine: an active principle isolated from *Corydalis*. *Clinical and Experimental Pharmacology and Physiology*, **8**, 738-742.
- [52] Chiou WF, Shum AY, Liao JF, Chen CF. (1997) Studies of the cellular mechanisms underlying the vasorelaxant effects of rutaecarpine, a bioactive component extracted from an herbal drug. *Journal of Cardiovascular Pharmacology*, **4**, 490-498.
- [53] Wang GJ, Wu XC, Chen CF, Lin LC, Huang YT, Shan J, Pang PK. (1999) Vasorelaxing action of rutaecarpine: effects of rutaecarpine on calcium channel activities in vascular endothelial and smooth muscle cells. *Journal of Pharmacology and Experimental Therapeutics*, **3**, 1237-1244.
- [54] Oh H, Kang DG, Lee S, Lee Y, Lee HS. (2003) Angiotensin converting enzyme (ACE) inhibitory alkaloids from *Fritillaria ussuriensis*. *Planta Medica*, **6**, 564-565.
- [55] Guh JH, Ko FN, Yu SM, Wu YC, Teng CM. (1995) Evaluation of N-methyl-actinodaphnine, a new vascular alpha-adrenoceptor antagonist, isolated from *Illigera luzonensis*. *European Journal of Pharmacology*, **1**, 33-41.
- [56] Tsai CC, Lai TY, Huang WC, Liu IM, Cheng JT. (2002) Inhibitory effects of potassium channel blockers on tetramethylpyrazine-induced relaxation of rat aortic strip in vitro. *Life Sciences*, **11**, 1321-1330.
- [57] Yu SM, Kang YF, Chen CC, Teng CM. (1993) Effects of dicentrine on haemodynamic, plasma lipid, lipoprotein level and vascular reactivity in hyperlipidaemic rats. *British Journal of Pharmacology*, **4**, 1055-1061.
- [58] Yu SM, Chen CC, Huang YL, Tsai CW, Lin CH, Huang TF, Teng CM. (1990) Vasorelaxing effect in rat thoracic aorta caused by denudatin B, isolated from the Chinese herb, *Magnolia fargesii*. *European Journal of Pharmacology*, **1**, 39-47.
- [59] Sotniková R, Kostálová D, Vavřková S. (1994) Effect of bisbenzylisoquinoline alkaloids from *Mahonia aquifolium* on the isolated rat aorta. *General Pharmacology*, **7**, 1405-1410.
- [60] Kawashima K, Hayakawa T, Miwa Y, Oohata H, Suzuki T, Fujimoto K, Ogino T, Chen ZX. (1990) Structure and hypotensive activity relationships of tetrandrine derivatives in stroke-prone spontaneously hypertensive rats. *General Pharmacology*, **3**, 343-347.
- [61] Kim HS, Zhang YH, Oh KW, Ahn HY. (1997) Vasodilating and hypotensive effects of fangchinoline and tetrandrine on the rat aorta and the stroke-prone spontaneously hypertensive rat. *Journal of Ethnopharmacology*, **2**, 117-123.
- [62] Zhang WB, Chen CX, Sim SM, Kwan CY. (2004) *In vitro* vasodilator mechanisms of the indole alkaloids rhynchophylline and isorhynchophylline, isolated from the hook of *Uncaria rhynchophylla* (Miquel). *Naunyn-Schmiedeberg's Archives of Pharmacology*, **2**, 232-238.
- [63] Carmignani M, Volpe AR, Delle Monache F, Botta B, Espinal R, De Bonnevaux SC, De Luca C, Botta M, Corelli F, Tafi A, Ripanti G, Monache GD. (1999) Novel hypotensive agents from *Verbesina caracasana*. 6. Synthesis and pharmacology of caracasandamide. *Journal of Medicinal Chemistry*, **16**, 3116-3125.
- [64] Chen CX, Kwan CY. (2001) Endothelium-independent vasorelaxation by leonurine, a plant alkaloid purified from Chinese motherwort. *Life Sciences*, **8**, 953-960.
- [65] Kakiyuchi, N., Senaratne, R.E., Huang, S., Yang, X., Hattori, M., Pilapitiya, U., Namba, T. (1991) Effects on constituents of *Beli* (*Aegle marmelos*) on spontaneous beating and calcium-paradox of myocardial cells. *Planta Medica*, **57**, 43-46.
- [66] Somova LI, Shode FO, Moodley K, Govender Y. (2001) Cardiovascular and diuretic activity of kaurene derivatives of *Xylopia aethiopica* and *Alepidea amatymbica*. *Journal of Ethnopharmacology*, **2**, 165-174.
- [67] Zhang C, Kuroyangi M, Tan BK. (1998) Cardiovascular activity of 14-deoxy-11,12-didehydroandrographolide in the anaesthetized rat and isolated right atria. *Pharmacological Research*, **6**, 413-417.
- [68] Tirapelli CR, Ambrosio SR, de Oliveira AM, Tostes RC. (2010) Hypotensive action of naturally occurring diterpenes: a therapeutic promise for the treatment of hypertension. *Fitoterapia*, **7**, 690-702.
- [69] Silva RM, Oliveira FA, Cunha KM, Maia JL, Maciel MA, Pinto AC, Nascimento NR, Santos FA, Rao VS (2005) Cardiovascular effects of trans-dehydrocrotonin, a diterpene from *Croton cajucara* in rats. *Vascular Pharmacology*, **1**, 11-18.
- [70] El-Bardai S, Wibo M, Hamaide MC, Lyoussi B, Quetin-Leclercq J, Morel N. (2003) Characterisation of marrubenol, a diterpene extracted from *Marrubium vulgare*, as an L-type calcium channel blocker. *British Journal of Pharmacology*, **7**, 1211-1216.
- [71] Guedes DN, Silva DF, Barbosa-Filho JM, Medeiros IA. (2004) Calcium antagonism and the vasorelaxation of the rat aorta induced by rotundifolone. *Brazilian Journal of Medicinal and Biological Research*, **12**, 1881-1887.
- [72] Lahlou S, De Barros Correia CA, Dos Santos VM, David JM, David JP, Duarte GP, Magalhaes PJ (2007) Mechanisms underlying the cardiovascular effects of a labdenic diterpene isolated from *Moldenhawera nutans* in normotensive rats. *Vascular Pharmacology*, **1**, 60-66.
- [73] Lahlou S, Figueiredo AF, Magalhães PJ, Leal-Cardoso JH, Gloria PD. (2004) Cardiovascular effects of methyleugenol, a natural constituent of many plant essential oils, in normotensive rats. *Life Sciences*, **19**, 2401-2412.
- [74] Interaminense LF, Leal-Cardoso JH, Magalhães PJ, Duarte GP, Lahlou S. (2005) Enhanced hypotensive effects of the essential oil of *Ocimum gratissimum* leaves and its main constituent, eugenol, in DOCA-salt hypertensive conscious rats. *Planta Medica*, **4**, 376-378.
- [75] Soares PM, Lima RF, de Freitas Pires A, Souza EP, Assreuy AM, Criddle DN. (2007) Effects of anethole and structural analogues on the contractility of rat isolated aorta: Involvement of voltage-dependent Ca²⁺-channels. *Life Sciences*, **13**, 1085-1093.
- [76] Esberg LB, Wang GJ, Lin YL, Ren J. (2003) Iso-S-petasin, a hypotensive sesquiterpene from *Petasites formosanus*, depresses cardiac contraction and intracellular Ca²⁺ transients in adult rat ventricular myocytes. *Journal of Pharmacy and Pharmacology*, **1**, 103-107.
- [77] Lee CN, Wong KL, Liu JC, Chen YJ, Cheng JT, Chan P. (1991) Inhibitory effect of stevioside on calcium influx to produce antihypertension. *Planta Medica*, **9**, 796-799.

- [78] Melis MS, Sainati AR. (1991) Participation of prostaglandins in the effect of stevioside on rat renal function and arterial pressure. *Brazilian Journal of Medicinal and Biological Research*, **12**, 1269-1276.
- [79] Melis MS. (1992) Stevioside effect on renal function of normal and hypertensive rats. *Journal of Ethnopharmacology*, **3**, 213-217.
- [80] Liu JC, Kao PK, Chan P, Hsu YH, Hou CC, Lien GS, Hsieh MH, Chen YJ, Cheng JT. (2003) Mechanism of the antihypertensive effect of stevioside in anesthetized dogs. *Pharmacology*, **1**, 14-20.
- [81] Ambrosio SR, Tirapelli CR, Bonaventura D, De Oliveira AM, Da Costa FB. (2002) Pimarane diterpene from *Viguiera arenaria* (Asteraceae) inhibit rat carotid contraction. *Fitoterapia*, **6**, 484-489.
- [82] Tirapelli CR, Ambrosio SR, da Costa FB, de Oliveira AM. (2004) Evidence for the mechanisms underlying the effects of pimaradienoic acid isolated from the roots of *Viguiera arenaria* on rat aorta. *Pharmacology*, **1**, 31-38.
- [83] Somova LI, Shode FO, Moodley K, Govender Y. (2001) Cardiovascular and diuretic activity of kaurene derivatives of *Xylopiia aethiopica* and *Alepidea amatymbica*. *Journal of Ethnopharmacology*, **2-3**, 165-174.
- [84] Bonito MC, Cicala C, Marcotullio MC, Maione F, Mascolo N. (2011) Biological activity of bicyclic and tricyclic diterpenoids from *Salvia* species of immediate pharmacological and pharmaceutical interest. *Natural Product Communications*, **8**, 1205-1215.

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

Review/Account

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 Climati, 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, Paweł Mituła, Natalia Niezgoda, Katarzyna Kempnińska, Joanna Wietrzyk and Czesław Wawrzeńczyk	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 Batçioğlu, 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 Riviére, Jean-Claude Delaunay, Pierre Waffo-Tégouo and Jean-Michel Mérellon	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 Nanthianantham 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. Sanandhiya, 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