elastogenic, but results of mutagenicity studies for the spice and some extracts are mixed; linalool is non-mutagenic. Coriander oil has broad-spectrum, antimicrobial activity. Coriander oil is irritating to rabbits, but not humans; it is not a sensitizer, although the whole spice may be. Based on the history of consumption of coriander oil without reported adverse effects, lack of its toxicity in limited studies and lack of toxicity of its major constituent, linalool, the use of coriander oil as an added food ingredient is considered safe at present levels of use [George A. Burdock & Ioana G. Carabin (Burdock Group, 801 N Orange Ave, Suite 710, Orlando, FL 32801, United States), Food Chem Toxicol, 2009, 47(1), 22-34].

**THERAPEUTICS**

**NPARR 1(1), 2010-105, Plantain (Plantago Linn.) species as novel sources of flavonoid antioxidants**

To examine the antioxidant properties of methanol extracts of selected Plantago species (P. argentea Chaix., P. holosteum Scop., P. major Linn., P. maritima Linn. and P. media Linn.), various assays that measure free radical scavenging ability were carried out: DPPH, hydroxyl radical, superoxide anion and nitric oxide scavenger capacity tests, reducing power (FRAP) assay and Fe²⁺/ascorbate induced lipid peroxidation. In all of the tests extracts showed a potent antioxidant effect compared with BHT, a well-known synthetic antioxidant, and the extract of P. major, accepted as an official remedy. Besides, in examined extracts the total phenolic amount (ranging from 38.43 to 70.97 mg of GAE/g of dw) and the total flavonoid content (5.31-13.10 mg of QE/g of dw) were determined. Furthermore, the presence and content of selected flavonoids (luteolin-7-O-glucoside, apigenin-7-O-glucoside, luteolin, apigenin, rutin and quercetin) were studied using LC-MS/MS technique. LC-MS/MS analysis showed noticeable qualitative and quantitative differences between the species according to which the examined Plantago species could be regarded as a possible new source of natural antioxidants. In this study three of the species examined, P. maritima, P. argentea, and P. holosteum, have been analyzed for the first time [Ivana N. Beara, Marija M. Lesjak, Emilija Jovin, Kristina J. Balog, Goran T. Ana kov, Dejan Z. Or and Neda M. Mimica-Duki (*Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovia 3, Novi Sad, Serbia), J Agirc Food Chem, 2009, 57(19), 9268-9273].

**NPARR 1(1), 2010-106, Inhibition of angiogenesis and inflammation by an extract of red clover (Trifolium pratense Linn.)**

Antiangiogenic compounds are gaining more and more interest as a new approach in the prevention and treatment of cancer and inflammatory diseases. The objective of this study was the evaluation of the antiangiogenic effect of a red clover extract (RCE) used in food supplements for menopausal complaints as well as of its main isoflavones in an in vivo system, the chorioallantoic membrane assay of fertilized hen’s eggs. At a dosage of 250 µg/pellet the red clover extract showed excellent inhibition of angiogenesis. The antiangiogenic activity of the non-methylated isoflavones daidzein and genistein was higher than that of the methylated compounds formononetin and biochanin A. The results demonstrate that RCE is not only suitable for menopausal complaints, but might also be a powerful chemopreventive agent against chronic diseases e.g. which have a high incidence especially in elderly female [L. Krenn and D.H. Paper (Department of Pharmacognosie, University Vienna, A-1090 Vienna, Austria), Phytomedicine, 2009, 16(12), 1083-1088].

**NPARR 1(1), 2010-107, In vivo genotoxicity evaluation of a plant based antiarthritic and anticancer therapeutic agent Boswelic acids in rodents**

The genotoxic potential of anti-inflammatory/anti-arthritic and anticancer plant based drug molecule Boswelic acids (BA) was studied by in vivo system. Systematic literature survey revealed that studies on the genotoxicity of BA are not available. Although reports on genotoxicity of Boswellia serrata Roxb. dry extract and modified 3-O-acetyl-11-keto-2-boswelic acid are available and these studies were conducted in in vitro systems. The earlier general toxicity study of BA has been conducted by us, revealed it to be non toxic. The
genotoxicity was carried out in Wistar rats using different cytogenetic assay systems—abnormalities, viz. chromosomal aberrations; sperm morphology, micronuclei and comet assays. Six groups of animals, each comprised of five rats, were taken for each study. Group 1-4 received BA at 125, 250, 500 and 1000 mg/kg p.o., respectively prepared as 2% gum acacia suspension, fifth group received a positive control cyclophosphamide (CP) 40 mg/kg p.o. or metronidazole (MTZ) 130 mg/kg p.o. or mercuric chloride (HgCl₂) 0.864 mg/kg p.o. (as per the experiment requirement) whereas the sixth group kept as vehicle control. The results on the basis of the data obtained revealed that BA is quite safe as it did not show any genotoxicity at any dose level up to 1000 mg/kg. The positive controls used in different experiments showed highly significant abnormal cytogenetic changes in comparison to the control group [R. Sharma, S. Singh, G. D. Singh, A. Khajuria, T. Sidiq, S. K. Singh, G. Chashoo, S. S. Pagoch, A. Kaul, A. K. Saxena, R. K. Johri and S. C. Taneja (Department of Pharmacology, Indian Institute of Integrative Medicine, CSIR, Canal Road, Jammu Tawi, J&K 180001, India), Phytomedicine, 2009, 16(12), 1112-1118].

NPARR 1(1), 2010-109, Vasodilatory actions of xanthones isolated from a Tibetan herb, Halenia elliptica D. Don

In this study, six major xanthones, isolated and identified from Halenia elliptica D. Don were investigated for their vasodilatory actions in isolated rat coronary artery. The xanthones, including 1-hydroxy-2,3,5-trimethoxy-xanthone (HM-1), 1-hydroxy-2,3,4,7-tetramethoxy-xanthone (HM-2), 1-hydroxy-2,3,4,5-tetramethoxy-xanthone (HM-3), 1,7-dihydroxy-2,3,4,5-tetramethoxy-xanthone (HM-4), 1,5-dihydroxy-2,3-dimethoxy-xanthone (HM-5) and 1,7-dihydroxy-2,3-dimethoxy-xanthone (HM-7) caused vasodilation in the coronary artery pre-contracted with 1 µM 5-hydroxytryptamine (5-HT), with EC₅₀ values ranging from 1.4±0.1 µM (HM-1) to 6.6±1.4 µM (HM-2). The EC₅₀ values of the other xanthones were between those of HM-1 and HM-2. Removal of endothelium of the coronary artery led to decreases in the vasorelaxant effects of HM-1, HM-7 but not HM-2, HM-3, HM-4 and HM-5. These results showed that xanthones isolated from H. elliptica are vasoactive substances which exhibit either endothelium-dependent or endothelium-independent mechanisms in rat coronary artery. The potency and mechanism(s) of the vasorelaxant effects of these xanthones may be relevant to the structure-activity differences in the level
and the position of the substituent groups with the primary xanthone structure [Yan Wang, Jian-Gong Shi, Mu-Zou Wang, Chun-Tao Che and John H.K. Yeung\(^a\) (\(^a\)Department of Pharmacology, Faculty of Medicine, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, China), *Phytomedicine*, 2009, 16(12), 1144-1150].

**NPARR** 1(1), 2010-110. *In vitro antioxidant and antihyperlipidemic activities of Bauhinia variegata Linn.*

The study was conducted to evaluate the ethanolic and aqueous extracts of *Bauhinia variegata* Linn. for *in vitro* antioxidant and antihyperlipidemic activity. Ethanolic and aqueous extracts of the stem bark and root of *B. variegata* Linn. were prepared and assessed for *in vitro* antioxidant activity by various methods namely total reducing power, scavenging of various free radicals such as 1,2-diphenyl-2-picrylhydrazyl (DPPH), super oxide, nitric oxide and hydrogen peroxide. The percentage scavenging of various free radicals were compared with standard antioxidants such as ascorbic acid and butylated hydroxyl anisole (BHA). The extracts were also evaluated for antihyperlipidemic activity in Triton WR-1339 (iso-octyl polyoxyethylene phenol)-induced hyperlipidemic albino rats by estimating serum triglyceride, very low density lipids (VLDL), cholesterol, low-density lipids (LDL) and high-density lipid (HDL) levels. Significant antioxidant activity was observed in all the methods, \((P<0.01)\) for reducing power and \((P<0.001)\) for scavenging DPPH, super oxide, nitric oxide, and hydrogen peroxide radicals. The extracts showed significant reduction \((P<0.01)\) in cholesterol at 6 and 24h and \((P<0.05)\) at 48h. There was significant reduction \((P<0.01)\) in triglyceride level at 6, 24, and 48h. The VLDL level was also significantly \((P<0.05)\) reduced from 24h and maximum reduction \((P<0.01)\) was seen at 48h. There was significant increase \((P<0.01)\) in HDL at 6, 24, and 48 h. From the results, it is evident that alcoholic and aqueous extracts of *B. variegata* Linn. can effectively decrease plasma cholesterol, triglyceride, LDL, and VLDL and increase plasma HDL levels. In addition, the alcoholic and aqueous extracts have shown significant antioxidant activity. By the virtue of its antioxidant activity, *B. variegata* Linn. may show antihyperlipidemic activity [GP Rajani\(^a\) and Purnima Ashok \(^a\) (\(^a\)Department of Pharmacology, K. L. E. Society’s College of Pharmacy, Bangalore, India), *Indian J Pharmacol*, 2009, 41(5), 227-232].

**NPARR** 1(1), 2010-111. *Antibacterial and antioxidant activity of methanol extract of Evolvulus nummularius* (Linn.) Linn.

The study was conducted to evaluate the antibacterial and antioxidant activity of methanol extract of *Evolvulus nummularius* (Linn.) Linn. Disc diffusion and broth serial dilution tests were used to determine the antibacterial activity of the methanol extract against two Gram-positive bacterial strains (*Bacillus subtilis* NCIM 2718, *Staphylococcus aureus* ATCC 25923) and three Gram-negative bacterial strains (*Pseudomonas aeruginosa* ATCC 27853, *Klebsiella pneumoniae* ATCC 70063 and *Escherichia coli* ATCC 25922). The methanol extract was subjected to preliminary phytochemical analysis. Free radical scavenging activity of the methanol extract at different concentrations was determined with 2, 2-diphenyl-1-picrylhydrazyl (DPPH). The susceptible organisms to the methanol extract were *Escherichia coli* (MIC=12.50 mg/ml) and *Bacillus subtilis* (MIC=3.125 mg/ml) and the most resistant strains were *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. The methanol extracts exhibited radical scavenging activity with IC50 of 350 µg/ml. The results from the study show that methanol extract of *E. nummularius* has antibacterial activity. The antioxidant activity may be attributed to the presence of tannins, flavonoids and triterpenoids in the methanol extract. The antibacterial and antioxidant activity exhibited by the methanol extract can be corroborated to the usage of this plant in Indian folk medicine [PS Pavithra, N Sreevidya, Rama S Verma\(^a\) (\(^a\)Department of Biotechnology, Indian Institute of Technology Madras, Chennai - 600 036, TN, India), *Indian J Pharmacol*, 2009, 41(5), 233-236].


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Euphorbia hirta Linn. is a weed commonly found in tropical countries and has been used traditionally for asthma, bronchitis and conjunctivitis. However, one of the constituents in this plant, quercetin was previously reported to be mutagenic. This work aimed to determine the level of quercetin in the aqueous and methanol plant extracts and to investigate the mutagenic effects of quercetin and the extracts in the Ames test utilising the mutant Salmonella typhimurium TA98 and TA100 strains. The antimutagenic activity of E. hirta aqueous and methanol extracts was also studied in S. typhimurium TA98. HPLC analyses showed that quercetin and rutin, a glycosidic form of quercetin, were present in the acid-hydrolysed methanol extract and non-hydrolysed methanol extract, respectively. The quercetin concentration was negligible in both non-hydrolysed and acid-hydrolysed aqueous extracts. The total phenolic contents in E. hirta were determined to be 268 and 93µg gallic acid equivalent (GAE) per gram of aqueous and methanol extracts, respectively. Quercetin (25µg/ml) was found to be strongly mutagenic in S. typhimurium TA98 in the absence and presence of S-9 metabolic activation. However, both the aqueous and methanol extracts did not demonstrate any mutagenic properties when tested with S. typhimurium TA98 and TA100 strains at concentrations up to 100 µg/ml in the absence and presence of S-9 metabolic activation. In the absence of S-9 metabolic activation, both the extracts were unable to inhibit the mutagenicity of the known mutagen, 2-nitrofluorene, in S. typhimurium TA98. On the other hand, the aqueous extract at 100 µg/ml and methanol extracts at 10 and 100 µg/ml exhibited strong antimutagenic activity against the mutagenicity of 2-aminoanthracene, a known mutagen, in the presence of S-9 metabolic activating enzymes. The results indicated that these extracts could modulate the xenobiotic metabolising enzymes in the liver at the higher concentrations [Daphne Sue Yen Loh, Hui Meng Er and Yu Sui Chen (School of Pharmacy and Health Sciences, International Medical University, No. 126, Jalan 19/155B, 57000, Bukit Jalil, Kuala Lumpur, Malaysia), J Ethnopharmacol, 2009, 126(3), 406-414].

In this report, the antilithiatic activity of Trachyspermum ammi (Linn.) Sprag. anticalcifying protein (TAP) was studied in urolithiatic rat model. Urolithiasis was induced by exposure of 0.4% ethylene glycol (EG) and 1.0% ammonium chloride (NH₄Cl) for 9 days. The efficacy of TAP was studied in another group given same dose of EG and NH₄Cl in addition to 2mg/kg body weight of TAP. The ability of TAP to inhibit the attachment of calcium oxalate (CaO₄) crystal in kidney tissue and studied the consequences of CaO₄ adhesion on renal functioning and tissue integrity was also evaluated. The antilithiatic potential of TAP was confirmed by its ability to maintain renal functioning, reduce renal injury and decrease crystal excretion in urine and retention in renal tissues. Thus, the present investigation suggests the potential of TAP in preventing calcium oxalate deposition and forms the basis for the development of antilithiatic drug interventions against urolithiasis [Tanzeer Kaur, Rakesh K. Bijarnia, Surinder K. Singla and Chanderdeep Tandon (Department of Biotechnology and Bioinformatics, Jaypee University of Information Technology, Waknaghat 173215, Solan, India), J Ethnopharmacol, 2009, 126(3), 459-462].

NPARR 1(1), 2010-114, Antimycobacterial terpenoids from Juniperus communis Linn. (Cupressaceae)

Juniperus communis is a plant which has been reported as a traditional cure for tuberculosis (TB) and other respiratory diseases. The aim of this study was to isolate and identify the constituents responsible for the activity of the n-hexane extract of Juniperus communis Linn. roots against Mycobacterium tuberculosis H₃⁷,Rv and J. communis aerial parts against Mycobacterium aurum. Subsequently, it was to evaluate the activity of the pure isolated compounds against (i) drug-resistant M. tuberculosis variants, (ii) non-replicating M. tuberculosis and (iii) a range of non-tuberculous mycobacteria (NTM). The antimycobacterial activity of J. communis extracts, fractions and constituents was determined against M. tuberculosis H₃⁷,Rv and against
rifampicin-, isoniazid-, streptomycin- and moxifloxacin-resistant variants, using the microplate broth Alamar Blue assay (MABA) method. Isolated constituents were tested against non-replicating M. tuberculosis H₃₇,Rv, using the low oxygen recovery assay (LORA) and against NTM (M. aurum, M. phlei, M. fortuitum and M. smegmatis), using a broth microdilution method. Cytotoxicity studies were performed using mammalian Vero cells.

The antimycobacterial activity of J. communis was attributed to a sesquiterpene identified as longifolene (1) and two diterpenes, characterised as totarol (2) and trans-communic acid (3). All compounds were identified following analysis of their spectroscopic data (1D- and 2D-NMR, MS) and by comparison with the literature and commercial authentic standards when available. Revised assignments for 3 are reported. Totarol showed the best activity against M. tuberculosis H₃₇,Rv (MIC of 73.7 µM). It was also most active against the isoniazid-, streptomycin-, and moxifloxacin-resistant variants (MIC of 38.4, 83.4 and 60 µM, respectively). Longifolene and totarol were most active against the rifampicin-resistant variant (MICs of 24 and 20.2 µM, respectively). Totarol showed the best activity in the LORA assay (MIC of 81.3 µM) and against all NTM species (MICs in the range of 7–14 µM). Trans-communic acid showed good activity against M. aurum (MIC of 13.2 µM). The low selectivity indices (SI) obtained following cytotoxicity studies indicated that the isolated terpenoids were relatively toxic towards mammalian cells. This is the first report of the isolation (1) and (2) from J. communis roots and of (3) from the aerial parts. The antimycobacterial activity of (1) and (3) and the activity of (2) against M. aurum, M. fortuitum and M. phlei, is reported for the first time. The effect of totarol on drug-resistant variants and non-replicating M. tuberculosis has never been published. The presence of antimycobacterial terpenoids in J. communis aerial parts and roots justifies, to some extent, the ethnomedicinal use of this species as a traditional anti-TB remedy [Andréa Y. Gordien, Alexander I. Gray, Scott G Franzblau and Véronique Seidel* (*Natural Products Research Laboratories, Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow G4 0NR, UK), J Ethnopharmacol, 2009, 126(3), 500-505].

NPARR 1(1), 2010-115 Assessment of antiradical potential of Calluna vulgaris (Linn.) Hull and its major flavonoid

Antioxidant capacity of the chloroform, ethyl acetate, n-butanol and water fractions of the aerial parts of Calluna vulgaris (Linn.) Hull (Ericaceae) has been assessed in this study. Antioxidant capacity of the plant was screened by assays of 2, 2-diphenyl-β-picrylhydrazyl, superoxide anion and hydrogen peroxide scavenging, metal-chelating activity and reducing power. Butylated hydroxyanisole was used as reference in all assays; ethylene diamine tetraacetic acid was also used as reference in the assay of metal-chelating activity. Total phenolic contents of the fractions were determined by the Folin-Ciocalteau method. Liquid chromatography/diode array detection/mass spectrometry was used for phytochemical identification of the fractions. Kaempferol-3-O-β-D-galactoside was found to be the major constituent in the ethyl acetate fraction (37.1 ± 0.9%), followed by the n-butanol fraction (46 ± 0.1%). High occurrence of antioxidant capacity, with the exception of metal-chelating activity, was observed in the ethyl acetate and chloroform fractions as well as in kaempferol-3-O-β-D-galactoside. C. vulgaris and its major flavonoid, kaempferol-3-O-β-D-galactoside, show high antioxidant capacity in various assays. As far as is known, this is the first report on antioxidant capacity of C. vulgaris and its major flavonoid [Didem Deliorman-Orhan, Sezer Senol, Murat Kartal, Ilkay Orhan* (*Department of Pharmacognosy, Gazi University, 06330 Ankara, Turkey), J Sci Food Agric, 2009, 89(5), 809-814].

NPARR 1(1), 2010-116 Novel hypoglycemic effects of Ganoderma lucidum water-extract in obese/diabetic (+db/+db) mice

In this study, the pharmacological effects of Ganoderma lucidum (G. lucidum) (water-extract) (0.003, 0.03 and 0.3g/kg, 4-week oral gavage) consumption using the lean (+db/+m) and the obese/diabetic (+db/+db) mice was evaluated. Different physiological parameters (plasma glucose and insulin
levels, lipoproteins-cholesterol levels, phosphoenolpyruvate carboxykinase (PEPCK), 3-hydroxy-3-methylglutaryl coenzyme A reductase (HMG CoA reductase) and isolated aorta relaxation of both species were measured and compared. *G. lucidum* (0.03 and 0.3g/kg) lowered the serum glucose level in +db/+db mice after the first week of treatment whereas a reduction was observed in +db/+m mice only fed with 0.3g/kg of *G. lucidum* at the fourth week. A higher hepatic PEPCK gene expression was found in +db/+db mice. *G. lucidum* (0.03 and 0.3g/kg) markedly reduced the PEPCK expression in +db/+db mice whereas the expression of PEPCK was attenuated in +db/+m mice (0.3g/kg *G. lucidum*). HMG CoA reductase protein expression (in both hepatic and extra-hepatic organs) and the serum insulin level were not altered by *G. lucidum*. These data demonstrate that *G. lucidum* consumption can provide beneficial effects in treating type 2 diabetes mellitus (T2DM) by lowering the serum glucose levels through the suppression of the hepatic PEPCK gene expression [S.W. Seto, T.Y. Lam, H.L. Tam, A.L.S. Au, S.W. Chan, J.H. Wu, P.H.F. Yu, G.P.H. Leung, S.M. Ngai, J.H.K. Yeung, S.M.Y. Lee and Y.W. Kwan (*Institute of Vascular Medicine, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong), *Phytomedicine*, 2009, 16(5), 426-436].

**NPARR 1(1), 2010-118, Hepatoprotective activity of Eugenia jambolana Lam. in carbon tetrachloride treated rats**

To estimate the hepatoprotective effects of the methanolic seed extract of *Eugenia jambolana* Lam. (Myrtaceae), in Wistar albino rats treated with carbon tetrachloride (CCl₄) was investigated. Liver damage in rats treated with CCl₄ (1ml/kg/Bw, administered subcutaneously, on alternate days for one week) was studied by assessing parameters such as serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), alkaline phosphatase (ALP), acid phosphatase (ACP) and bilirubin (total and direct). The effect of co-administration of *E. jambolana* Lam. (doses 100, 200 and 400 mg/kg p. o.) on the above parameters was investigated. These biochemical observations were supplemented by weight and histological examination of liver sections. Liv.52 was used as positive control. Data were analyzed by one way ANOVA, followed by Scheff’s/Dunnett’s test. Administration of *E. jambolana* Lam. (doses 100, 200 and 400 mg/kg p. o.) significantly prevented carbon tetrachloride induced elevation of serum SGOT, SGPT, ALP, ACP and bilirubin (total and direct) level. Histological examination of the liver section revealed hepatic regeneration, after administration of various doses of *E. jambolana* Lam. The results were comparable to that of Liv.52. The study suggests preventive action of *E. jambolana* Lam. in carbon tetrachloride induced liver toxicity. Hepatic cell regeneration process was dose dependent [SS Sisodia, M Bhatnagar (*Department of Pharmacology, Bhupal Nobles’ Girls College of Pharmacy, Udaipur, Rajasthan, India), *Indian J Pharmacol*, 2009, 41(1), 23-27].

**NPARR 1(1), 2010-117, Treatment of oral thrush in HIV/AIDS patients with lemon juice and lemon grass (Cymbopogon citratus) and gentian violet**

The purpose of the study was to investigate the safety and efficacy of lemon juice and lemon grass (*Cymbopogon citratus*) in the treatment of oral thrush in HIV/AIDS patients when compared with the control group using gentian violet aqueous solution 0.5%. Oral thrush is a frequent complication of HIV infection. In the Moretele Hospice, due to financial constraints, the treatment routinely given to patients with oral thrush is either lemon juice directly into the mouth or a lemon grass infusion made from lemon grass (*Cymbopogon citratus*) grown and dried at the hospice. These two remedies have been found to be very efficacious therefore are used extensively. Gentian violet, the first line medication for oral thrush in South Africa, is not preferred by the primary health clinic patients due to the visible purple stain which leads them to being stigmatized as HIV-positive. *Cymbopogon citratus* and *Citrus limon* have known antifungal properties [S.C. Wright, J.E. Maree and M. Sibanyoni (‘Adelaide Tambo School of Nursing Science, Tshwane University of Technology, Staatsartillerie Road, Pretoria-West, Pretoria 0001, Gauteng, South Africa), *Phytomedicine*, 2009, 16(2-3), 118-124].