CHAPTER I

CERTAIN PHYTO CHEMICALS PRESENT IN MEDICINAL PLANTS AND THEIR THERAPEUTIC ROLE

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The Unread Parts of Medicinal Plants

Many of us believe that the pharmacologically active compounds produced by medicinal plants are being specially made for human use. When we ponder over it deeply we can understand that these compounds are synthesized by the plants (phytochemicals) only for the protection and well being of the plants themselves. Cattle or worms do not eat away the leaves or fruits of such plants as they are bitter in taste. e.g., lemon grass and citrus plants, citrus fruits, leaves of bael tree (aegle marmelos) and amla (goose berry).

We use the leaves, flowers, bark, fruits or the roots of medicinal plants as the case may be for the preparation of the medicines e.g., Rasayana, Choorna, decoctions, essential oils etc. This is because the pharmacologically active compounds are stored in one or other parts of the plants in order to repel the insects, worms, flies, bacteria or virus in the air, water or soil with which the plants are in permanentt contact. **When Bhopal gas leakage tragedy** took place in 1984, leaves of most of the plants there wilted away due to the toxicity of methyl isocyanate. But four species of plants viz, Ficus bengalensis, Mangifera indica, Artocarpus integrifolia and Cusurina equiseto folia were found to be completely resistant to the gas and survived the crisis. The protective effects of trees like F.bengalensis (pipal tree) are due to the phenolic / flavonoid groups of compounds present in the barks of those trees[1]. The methyl isocyanate leaked out from the industry was neutralized by a reaction of the aromatic hydroxyl groups present in the phenols and flavanoids of the bark.

$$\underset{\text{Aromatic hydroxyls}}{Ar\,OH} + \underset{\text{Methyl isocyanate}}{CH_3\,NCO} \longrightarrow \underset{\text{Urethanederivative (Neutralized product)}}{Ar.OCONH.CH_3}$$

Various forms of the flavanoids present in the bark of pipal tree e.g.; leucopelargonidin[2] and leucocyanidin[3] derivatives are antidiabetic in action. Therefore we may be surprised to observe that the compounds synthesized and stored in different parts of the plants for their own protection are tapped by man for curing or preventing various diseases. Insects, birds or animals do not eat amla as it is very bitter in taste. The poly phenols in the fruits are protecting amla which are used as medicines by man. Similar are the taste and protection of tea leaves and their use by man. Caffeine of coffee seeds deter insects and animals from eating them.

The consumption of food materials that contain many nutraceuticals / nutritional medicines help us successfully to prevent or delay the onset of diseases such as CVD, Cancer, diabetes, Alzheimer's disease, various infections etc. The major functional foods (that function as medicines in the body) that contain nutraceuticals like caretenoids, terpenes, phytosterols, flavonoids or poly phenols, theols (sulfoxides and polysulfides) and non toxic alkaloids like piperine are carrots[4], ginger[5], citrus fruits[6], cardamom[7], soyabeans[8], pomegranate[9], broccoli[10], turmeric[11], tea[12], goose berry (amla)[13], garlic[14], onions[15], grapes[16], black pepper[17], apple and cabbage[18]. The term functional food is also used for food materials containing nutraceuticals.

Many Medical doctors support the roles of functional foods.

Medical doctors like Arun Bordia (Rtd.Cardiologist, RNT Medical College Udaipur), H.A.Dewar (Rtd.Cardiologist of Royal Victoria Infirmary New Castle Upon Tyre U.K), Benjamin Lau (Rtd.immunologist Loma Linda University California), Madhavan Kutty (Rtd.D.M.E.Govt. of Kerala), K.J.Mathew (Rtd.Prof. of Community Medicine Kottayam Medical College), Mathew Parackan (Rtd.Physician of Kottayam Medical College), C.P.Mathew (Rtd.Prof. of Radiology Kottayam Medical College), K.P.Poulose (Rtd. Prof of Medicine Trivandrum Medical College), K.Bhaskaran (Former Principal of Pariyaram Medical College, Kannur, Kerala), Suresh Datta (Former Director, Malabar Cancer Hospital, Thalassery),and Regi Jose, (Asst. Professor, Karakonam Medical College)are few examples among the supporters of functional foods as sources of disease preventive medicines**. Many of the phytomedicines are typical examples for nutraceuticals as well as for strong naturally existing protective agents in plants that keep them healthy strong and also aloof from noxious infections.** Dr.K.Bhaskaran explains the importance of functional foods as follows. The role of phytomedicines in the up keep of the plants is the basic principle of using them against human diseases[4]. He further adds that even preparations very similar to natural human hormones are now synthesized from plant sources by the introduction of gene cloning. *Various phytochemicals are now available for replacement therapy in endocrine deficiencies*. Active hexole correlated compounds (AHCC), say Bhaskaran and Benjamin Lau, increase the levels of the natural killer cells (NK), T Cells, macrophages and interleukins 1 & 2 in our body. This role of the nutraceuticals stimulates the immune response of the cells against infections. Regular use of garlic pulp along with boiled milk for a week gave prophylactic protection to many students against jaundice during its episode in Kerala (2004-2006) according to the experience of the author of this article.

A study in the U.S.A revealed that 72% of the people there take herbal products as food supplements to feel better, 67% to prevent illness, 50% to live longer, 37% to build muscles and strength, 12% for weight management and 33% on the advice of their physicians. 53% said nutraceuticals offered benefits comparable to drugs but with fewer side effects Ramarkably 95% were satisfied with these supplements[4]. Another interesting thing to note is that adverse effects of nutraceuticals in patients already on modern drugs e.g.; insulin, paracetamol, aspirin etc. are rarely reported. This is because they are parts of our food and our body is adapted to their use and metabolism in the cells. Once their biological functions as antioxidant, hypotensive, hypoglycemic, hypocholesterolemic, antiatherogenic, anticancer, anti-inflammatory, antibacterial, antiviral and antiplatelet aggregating effects are over they are metabolized as easily as any other food component in our food! Most of the phytochemicals that are dealt with in this book viz., herbal compounds with units chained or polymerized but individually on digestion become very similar in composition to the simple forms of terpenes, carotenoids, phytosterols, flavonoids, polyphenols, thiols (poly sulfides and their sulfoxides like ajoene) and nontoxic alkaloids like piperine which can be metabolized in the body easily. Tannin of tea is a good precursor of poly phenols which are easily formed on digestion in the GIT. **As they are easily metabolized and excreted they do not damage our organs, on the contrary they are cardioprotective, hepatoprotective, pulmonary protective and antiageing in actions. With aging people become prone to pandemic. Only Nutraceutical rich food and exercise can save us from such infections.**

It is very surprising to note that these phytochemicals work as medicines both in the plants as well as in the human body. Therefore plants in a sense are equally our brothers and sisters as the animals are ever for us on this planet. We are bound to protect plants not only for environmental protection or as a source of food, but for the prevention of human diseases as well as for curing the same. Our ancestors, particularly during their forest life as tribes, adivasis or Hermits discovered the medicinal values of many plants by a method of trial and error. The ancient medical systems like practices of Chinese medicine, Ayurveda, Siddha and Unani enriched themselves with the discovery of medicinal values of various plants in the East and Middle East parts of the world. Folk lore medicines were in practice in various parts of Europe. These systems did great service to humanity to cure various diseases before modern medicines came into practice by the middle of 18th century.[19, 20] Very recently when Chikungunya raged Kerala (2006-08) the allopathic treatments could cure only the fever part of it. The patients subsequently developed swellings and pains on the joints. Many became immovable for a year or two with this disease. However those who under went Ayurvedic treatment, with a decoction e.g., of ginger, garlic, black

pepper, long pepper and cumin, easily got cured not only from fever but they never developed the accompaning ailments. In China they treat all types of viral fevers with a preparation of garlic and ginger in Vinegar. The author when visited China in 2004 noticed this in a workshop at Beijing and later he developed a three in one food complex as a remedy for all bacterial and viral infections . This is how it should be prepared and used both prophylactically and curatively against Chickunguniya and other viral fevers.. Ground garlic pulp, powdered dry ginger and black pepper were mixed together in the ratio of 16:4:1 by wt. and used daily at a dose of 10g/day in boiled milk or rice gruel for two weeks. Regular use of this food complex prevented the infection of viral diseases in many of author's students and friends during 2006-2008 For infected people treatment with it for 1 to 2 months cured all of their joint pains and swellings due to chikungunlya. The mechanism of action of this syrup is stimulation of immune cells for body protection[20]. The stock preparation of the three in one food complex can be stored in refrigerator. Many phytochemicals / Nutraceuticals can be a part of our food so that toxins like Pb, Hg, Cd, nicotine etc. could be detoxified and the incidence of cancer can be reduced[21,22]. Uses of nutraceuticals and exercise clean up the tissues, lower the level of LDL (bad cholesterol) and increase the level of HDL (good chole.) in blood and protect the body from various infections through improving immune response of the body.

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MEDICINAL PLANTS FROM ABRUS PRECATORIOUS TO CYBOPOGON

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1. ABRUS PRECATORIOUS .L

Syn. *A. minor* or *A. pauciflorus.L*

Common name: Kunni

Parts used: Roots, seeds and leaves. Powdered form of whole plants

Abrus precatorius is of the family fabaceae belonging to the plant kingdom plantae. It is a vascular plant of the order fabales. A.precatorius (leguminosae) is a perennial plant that grows in tropical and subtropical areas of the world. It has been used for the treatment of various diseases such as colds, cough, convulsion, fever, rheumatism, conjunctivitis and ulcers by traditional healers. Nath and Sethi 1992 (1) reported its arbortifacient properties. Rain Tree 2004 (2) reported its use in the treatment of diabetes and chronic nephritis. Various African tribes use powdered forms of the plant as oral contraceptives (3,4).

Chemical constituents isolated are

Glucoside, abrusic acid, haemagglutinin, poisonous proteins, a fat splitting enzyme and abrin (5). Cycloartane glycoside, designated abrusoside E, 3_-O-[_- glucuronopyranosyl-(1 _ 2)-_- -glucopyranosyl] (20S, 22S)-3_, 22-dihydroxy-9, 19-cyclolanost-24-en-26, 29-dioic acid _-lactone (6).

Evaluation of the anti-inflammatory activity of extract of Abrus precatorious

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Eastern Journal of Medicine 14 (2009) 23-25

The anti-inflammatory activity of the extract of Abrus precatorius was investigated in their study. Inflammatory response was induced by topical application of croton oil dissolved in suitable vehicle on the rat ear. After 6 hrs, cutting out the ear quantitated the response. The cut ear is weighed and the increase in weight relative to controls evaluated. Extract of A. precatorius when co applied with croton oil to the rat ear showed a reduction in the inflammatory response produced when croton oil alone was applied to the rat ear. The extract produced 67.10 + 2% reduction of the inflammatory response showed by croton oil alone, this was however lower than the 71.1 + 2% reduction of the inflammatory response produced by acetyl salicylic acid. This finding suggests that extract of A. precatorius exhibits anti-inflammatory activity and might explain the usefulness of the leaves of this plant in the treatment of inflammatory disease conditions by traditional healers.

Protective Effect of Abrus Precatorius Seed Extract following Alcohol Induced Renal Damage

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This study investigated the renal protective activities of the seed extract of abrus precatorius following alcohol induced renal damage in adult male Sprague dawley wister rats. Experimental rats were divided into six groups of five rats per group. Renal damage was induced with alcohol (1.6g/kg) orally. The treated group received the crude extract (200mg/kg) orally in addition to alcohol for six weeks, with normal feeds and water ad libitum. Histological studies, biochemical indicators of renal function and thiobarbituric acid-reactive substances, as markers of lipid peroxidation, were thereafter determimed. Oral administration of alcohol caused significant elevation of serum potassium and sodium levels as well as creatinine and malondialdehyde levels. There were structural alterations in renal tubules, glomerular infiltration by chronic inflammatory cells. Concurrent administration of same doses of alcohol and seed extract of abrus precatorius resulted in a suppression of alcohol- induced renal injury. Measurement of malondialdehyde level indicated that this effect is related to the attenuation of alcohol induced lipid peroxidation by the seed extract ($p<0.05$). They conclude that the seed extract of abrus precatorius could protect the kidney against alcohol- induced parenchymal injury.

Antifertility effects of ethanolic seed extract of Abrus precatorius L. on sperm production and DNA integrity in adult male mice

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Abrus prectaorius L. is one of the folk medicinal plants widely used as an antifertility agent in various places of Pakistan. This study was to investigate the antifertility activity of A. prectaorius seed extract intraperitoneally administered on sperm production and DNA integrity of spermatozoa in adult male albino mice of BALB/c strain. The daily sperm production was measured by counting testicular spermtids in Horwell chamber while DNA damage in epididymal spermatozoa was determined by comet assay. The intraperitoneal administration of 20 and 60 mg/kg of ethanolic seed extract of A. precatorius caused a highly significant ($p\leq0.001$) decrease in daily sperm production. The reversibility in sperm production was observed in all the treated animals after 20 days of withdrawal of treatment. Similarly, a highly significant increase ($p \leq 0.001$) in DNA damage was observed in all the treated animals and no significant reversibility in DNA damage was observed during treatment period. This study suggests the role of seed extract of A. precatorius as an antifertility agent or contraceptive with a risk of DNA damage in spermatozoa and may lead to teratogenic effects. The seed extract of A. precatorius has a capability to induce DNA damage for sometime even after withdrawal of treatment. The best possible mechanism for the dose dependent effect of seed extract of A. precatorius on DNA integrity may involve production of reactive oxygen species by interaction of toxic proteins of seeds of A. precatorius that is, abrin and agglutinin with the antioxidant proteins of the cell.

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2. ACACIA CATECHU WILLD

Syn. A. suma, A. wallichiana, A. polycantha

Common name: Khadiram(Karingali)

Parts used: Bark, wood, flowering tops and gum

Main chemical constituents are catechin, catechuic acid, pyrocatechin, phloroglucin, protocatechuic acid, quercetin, gum and mineral. Catechu, a product of Acacia catechu, has hepatoprotective, antipyretic and digestive properties.[1], Cyanidanol, an active principle of Acacia catechu , is claimed to be effective in treating liver diseases. Catechu was used in the treatment of diarrhoea and throat infection because the tannin and polyphenols present in it impart astringent activity.

Action :

Tannins / Catechin :

1. It restores antioxidant enzyme superoxide (SOD) from the radiation inducing damage.
2. It helps to prevent free radical oxidative damage to cells.
3. It shows reduction in membrane fluidity.
4. It restores and maintains the balance of aminoacids in osteoarthritis.
5. It shows thermogenic properties and promotes fat oxidation.
6. It shows inhibitory effect against tumour cells (particularly against breast cancer, colon, lung carcinoma and melanoma).

Biochemical study on the hypoglycaemic effects of extract and fraction of Acacia catechu willd in alloxan-induced diabetic rats

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Various extracts including petroleum ether, chloroform, acetone, ethanol, aqueous and crude aqueous of barks of Acacia catechu (A. catechu) Willd (Leguminosae) and the two fractions of ethanolic extract were tested for antihyperglycaemic activity in glucose-loaded hyperglycaemic rats. The effective extract and fraction of A. catechu were subjected to anti-diabetic study in alloxan-induced diabetic rats at two dose levels, 200 and 400 mg/kg, respectively. Biochemical parameters, including glucose, urea, creatinine, serum cholesterol, serum triglyceride, high density lipoprotein (HDL), low density lipoprotein (LDL), haemoglobin and glycosylated haemoglobin were assessed. The ethanolic extract of A. catechu and the water insoluble fraction of ethanolic extract exhibited significant anti-hyperglycaemic activity and produced dose- dependent hypoglycemia in fasted normal rats. Treatment of diabetic rats with ethanolic extract and water-insoluble fraction of this plant restored the elevated biochemical parameters significantly ($p<0.05$) to the normal level. Comparatively, the water insoluble fraction of ethanolic extract was more effective than the ethanolic extract and the activity was comparable to that of the standard, glibenclamide (5 mg/kg). In this study the maximum activity was found in ethanolic extract and water insoluble fraction of ethanolic extract, which contains alkaloids along with flavonoids that were not found in any other extracts and fraction. Alkaloids are absent in the crude aqueous extract and water soluble fraction of ethanolic extract in which the activity was found to be minimum or nil. This confirms that it was the role of alkaloids in ethanolic extract and water insoluble fraction to exhibit antidiabetic activity along with flavonoids and a lot of alkaloids are reported to have antidiabetic activity.

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3. ACORUS CALAMUS LINN

Syn. A. odoratus

Common name: Vayambu (sweet flag)

Parts used: roots and rhizomes

Acorus calamus Linn. commonly known as Sweet Flag, belongs to the family Araceae (Adoraceae). It is also called as Acorus odoratus. The genus Acorus derived from Acoron (coreon = the pupil of the eye) and the species calamus is derived from the Greek word Calamos (a reed). The family Araceae comprises about 110 genera and more than 1,800 species. The members of the family are rhizomatous or tuberous herbs. Acorus calamus Linn. commercially occurs in both peeled and unpeeled forms. This perennial herb is common on the banks of streams and in damp marshy places. The sweet flag oil present in this plant is a unique source of oxygenated sesquiterpenes of great structural variety (1). Apart from this terpenes a few commonly occurring steroids and xanthones had also been reported. The rhizome of the plant has medicinal properties against bugs, moths, lice, emetic stomach in dyspepsia; etc (2). Common names of Acorus calamus which are used in different parts in India are Bach (Hindi), Vashampu (Tamil), Baje (Kannada) and Vasa (Telugu). Different parts of the plant have been subjected to exhaustive extraction and the isolated constituents were reported in the literature, which includes Terpenoids, Steroids, Xanthones, Lignans, Flavones and presence of traces of alkaloids.

Therapeutic efficacy of Acorus calamus on acetaminophen induced nephrotoxicity and oxidative stress in male albino rats

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The aim of this study was to investigate the nephroprotective and antioxidant activities of ethanol extract of Acorus calamus (AC) at two dose levels of 250 and 500 mg/kg B/W on acetaminophen (APAP) induced toxicity in male albino rats. APAP significantly increased levels of serum urea, hemoglobin (Hb), total leukocyte count, packed cell volume, creatinine, DLC, and mean corpuscular volume, raised body weight, and reduced levels of neutrophils, mean corpuscular Hb content, mean corpuscular hematocrit, granulocytes, uric acid, and platelet Concentration. AC inhibited the hematological effects of APAP. AC significantly increased activities of renal superoxide dismutase, catalase, glutathione, and glutathione peroxidase and decreased malondialdehyde content of APAP-treated rats. Apart from these, histopathological changes also showed the protective nature of the AC extract against APAPinduced necrotic damage of renal tissues. In conclusion it was observed that the ethanol extract of AC conferred nephroprotective and antioxidant activities by histopathological and biochemical observations against APAP induced renal damage in rats.

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4. ADHATODA VASICA Nees: VASAKA

Common Name: Adalodakom

Parts Used : Leaves, flowers, bark and roots

CHEMICAL CONSTITUENTS

The leaves of the plant contain an essential oil and alkaloids vasicine, N-oxides of vasicine, vasicinone,deoxyvasicine and maiontone. The roots are known to contain vasicinolone, vasicol, peganine

and 2' - hydroxy - 4 - glucosyl -oxychalcone. The flowers contain β-sitosterol-D-glucoside, kaempferol, its glycosides and quereetin

Adhatoda vasica, called Vasa or Vasaka in Sanskrit. The leaves, the roots and flowers of Adhatoda vasica are extensively used in indigenous medicine as remedy for cold, cough, bronchitis and asthma. Both the decoctions and powder from constituents of many preparations used in the Ayurvedic medicine for various afflictions of the respiratory tract. In chronic bronchitis and asthma it is said to be very useful. The medicine was considered so useful in tuberculosis that it was said that no man suffering form this disease need despair as long a vasica plant exists in this world. The juice of the leaves is used in diarrhoea and dysentery and powdered leaves in malaria in southern India.

Adhatoda vasica is traditionally used in many of the following ways:

- Juice from the leaves and the decoction of the leaves and roots are helpful in asthma, bronchitis and chronic coughs and breathlessness.
- Used for bleeding due to idiopathic thrombocytopenic purpura, local bleeding due to peptic ulcer, piles, menorrhagia.
- Relief in pyorrhoea and for bleeding gums by local application.
- Relieves or eases muscular spasms, cramps or convulsions
- Stimulates contraction of the uterine muscle, facilitating or speeding up childbirth
- Lowers blood pressure

PHARMACOLOGICAL ACTIVIES AND CLINICAL TRAILS

Abortifacient activity

A survey programme was organised in Lucknow and Farrukhabad, two towns of Uttar Pradesh, from March 1987 to July 1987. During the survey, the common folk medicine plants used by women were recorded and Ayurvedic and Unani drug encyclopedias were consulted for the antireproductive potential of these plants. Aqueous or 90% ethanol extracts of the plants of interest were studied in rats orally dosed for 10 days after insemination with special reference to effects on foetal development. Leaf extracts of Moringa oleifera and Adhatoda vasica were 100% abortive at doses equivalent to 175 mg/kg of starting dry material.

Anti-allergic activity: A methanolic extract from the entire plant has been shown to possess anti-allergic activities in the guineapig after inhalation or intragastric administration at doses of 6 mg per animal or 2.5 gm/kg, respectively. Compound 73/602 (AA) is a structural analogue of vasicinone, an alkaloid present in the leaves and roots of Adhatoda vasica (Acanthaceae). It possesses potent antiallergic activity in mice, rats and guinea pigs. The pK (a) of AA was determined to be 2.87 +/-0.19 by UV spectrophotometry. The absorption kinetics of this compound was studied in-situ using a rat gut technique at pH 2.6 and 7.4. The rate of absorption at pH 2.6 (0.0288 +/- 0.004 min (-1)). This characteristic behavior was attributed to the low pK (a) of AA, weekly basic compounds, where nearly 35% of the compound remained in the unionized form at pH 2.6. Also, the return of compound into the mucosal lumen from the blood capillaries over a period of 2 h after administering a 2 mg dose in tail vein was less than 0.3%. Hence it was concluded that entero-enteric circulation of AA did not contribute significantly to the in-situ absorption rates. Pharmacokinetic parameters of AA were determined in male rats after administering a single 10 mg/kg intravenous dose (i.v.) and 50 mg/kg oral bolus dose. Following i.v. administration the initial decline in serum concentration was rapid with half-life of 20.2 min. after a single oral dose the concentration-time data of AA in rats was 50.6 min, indicating absorption rate limiting disposition at the high dose given. Comparison of ACU of oral and i.v. data indicates that only about 60% of the oral dose reaches the systemic circulation. Structure-activity relationships obtained from in vitro screening results obviously indicate that the highest inhibition effects on cyclooxygenase and 5-lipoxygenase are found amongst the class of phenolic compounds (flavonoids, polyphenols, coumestans, phenol carboxylic acids)

and arachidonic acid analogous (alkylamides, retinoids, arylheptanoids, thiosulfinates, sulfinyl disulfides). The antiinflammatory activities of some triterpenenic acids, sesquiterpene lactones and polysaccharides may be due to their immunomodulating activities on the complement and/or T-lymphocyte populations, respectively. in the search for potential antiallergic and antiasthmatic compounds, the thiosulfinates of onion were found to be active principles of the drug. The mechanism of action of some other antiallergic plant drugs (i.e. Tylophora asthmatica, Adhatoda vasica, etc.) has not yet been clarified.

Anti-asthmatic activity: A methanolic extract from the entire plant has been shown to possess anti-asthmatic activities in the guinea-pig after inhalation or intragastric administration at doses of 6 mg per animal or 2.5 gm/kg, respectively.

Hitherto unknown alkaolids from Adhatoda vasica showed pronounced effects against allergen-induced bronchial obstruction in guinea pigs (10 mg/ml aerosol). Androsin from picrohiza kurroa prevented allergen- and PAF-induced bronchial obstruction (10 mg/kg orally; 0.5 mg inhalative). Histamine release in vitro was inhibited by other compounds of the plant extract yet to be identified. Pharmacological effects of plant extracts and pure compounds in man are under investigation.

Anti-inflammatory activity

Adhatoda vasica Nees is a shrub widespread throughout the tropical regions of Southeast Asia. It possesses a wide spectrum of medicinal properties including positive effects on inflammatory diseases. The antiinflammatory activity of the methanol extract, the non-alkaloid fraction the saponins and the alkaloids was evaluated by the modified hen's egg chorioallantoic membrane test. The alkaloid fraction showed potent activity at a dose of 50 microg/pellet equivalent to that of hydrocortisone while the MeOH extract and the other fractions showed less activity.

Anti-microbial activity

The present report deals with the preliminary experiments designed to evaluate the in vitro effects of Adhatoda vasika (ARDUSI) leaf (AVL) extract on micro-organisms of inflamed gingiva by employing antibiotic sensitivity test by disc diffusion method. In vitro sensitivity test with AVL extract on microorganism of inflamed gingiva showed significant antimicrobial activity.

Anti-tubercular activity of the oil obtained from leaves flowers and roots of vasica plant possesses significantly high activity against tubercle bacilli. The growth of M.tuberculosis B 19-4 (human) is inhibited in a concentration of 2 µg.; that of B 19-3 (bovine) partially in a concentration of 2 µg./c.c., and completely in a concentration of 5µg; while of B19-1 (avian) strain is inhibited completely in a concentration of 5 µg. the anti-tubercular activity of the active principle form leaves is twice less than that of streptomycin. The action of the active principle is specific fro tubercle bacillus. The growth of non-acidfast bacteria is not inhibited in a concentration of 500 µg./c.c. The drug in a dose of 2.3g/kilo body-weight when injected subcutaneously to mice does not produce any toxic symptoms. Five hundred mg./kilo injected subcutaneously in guinea-pig does not produce any toxic symptoms. The oil has low toxity for paramecia. 1/5,000 dilution of the oil does not kill these in one hour.

Anti-tussive activity. The antitussive activity of Adhatoda vasica (AV) extract was evaluated in anaesthetized guinea pigs and rabbits and in unanaesthetized guinea pigs. AV was shown to have a good antitussive activity. Intravenously, it was 1/20-1/40 as active as codeine on mechanically and electrically induced coughing in rabbits and guinea-pigs. After oral administration to the guinea-pig the antitussive activity of AV was similar to codeine against coughing induced by irritant aerosols.

Bronchodilatory activity. The pharmacological actions of vasicinone on the bronchial musculature were studied on the guinea pig tracheal chain, on perfused guinea-pig lung and by the overflow method in intact guinea pigs. Vasicinone had a definite bronchodilator action on the normal lungs and a powerful bronchodilator action against the histamine-induced bronchoconstriction; but its action was weaker than adrenaline. Laevo-vasieinone was howevere, stronger in action than its DL-from. Vasicinone showed a slight and transient fall in the blood pressure of a dog. On isolated perfused hearts of guinea pig and rabbit vasicinone had a positive inotropic action and increased the flow in the coronary vessels. Both L-and DL-

forms of vasicine displayed a brochoconstrictor action, had a negative inotropic action on the heart and also reduced the flow in the coronary vessels.

Chemopreventive efficacy: The effecst of two different doses (50 and 100 mg/kg body wt/day for 14 days) of 80% ethanolic extract of the leaves of Adhatoda vasica were examined on drug metabolizing phase 1 and phase 11 enzymes, antioxidant enzymes, glutathione content, lactate dehydrogenase and lipid peroxidation in the liver of 8 weeks old Swiss albino mice. The modulatory effect of the extract was also examined on extra-hepatic organs viz. lung, kidney and forestomach for the activities of glutathione S-transferase, DT-diaphorase, superoxide dismutase and catalase. Significant increase in the activities of acid soluble sulfhydryl (-SH) content, cytochrome P450, NADPH-cytochrome P450 reductase, cytochrome b5, NADH-cytochrome b5 reductase, glutathione S-transferase (GST), DT-diaphorase (DTD), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and glutathione reductase (GR) were observed in the liver at both dose levels of treatments. Adhatoda vasica acted as a bifunctional inducer since it induce both phase 1and phase 11 enzyme systems. Both the treated groups showed significant decrease in malondialdehyde (MDA) formation in liver, suggesting its role in protection against prooxidant induced membrane damage. The cytosolic protein was significantly inhibited at both the dose levels of treatment indicating the possibility of its involvement in the inhibition of protein synthesis. BHA has significantly induced the activities of GR and GSH in the present study. The extract was effective in the present study. The extract was effective in inducing GST and DTD in lung and forestomach and SOD and CAT in kidney. Thus, besides liver other organs viz., lung, kidney and forestomach were also stimulated by Adhatoda, to increase the potential of the machinery associated with the detoxification of xenobiotic compounds. But, liver and lung showed a more consistent induction. Since the study of induction of the phase 1 and phase 11 enzymes is considered to be a reliable marker for evaluating the chemopreventive efficacy of a particular compound, these findings are suggestive of the possible chemopreventive role played by Adhatoda leaf extract**.**

Hypoglycaemic activity Ethanolic extracts from the leaves showed hypoglycaemic activity after oral administration in rats and rabbits**.**

Muscle relaxant activity: An essential oil from the leaves of vasica showed smooth muscle relaxant activity in the isolated guinea-pig tracheal chain.

Thrombopoletic activity: Repeated oral and intramuscular administration of vasicine (an alkaloid from Adhatoda vasica) resulted in an increase in platelet count in normal rats, mice, rabbits and dogs. This increase in platelets was also associated with significant hyperplasia of megakaryocytes in the bone marrow. No effects were observed on haemoglobin level and RBC or WBC counts and morphology. Bleeding and clotting times were not significantly altered nor was there any evidence of *in vitro* haemolysis. Vasicine did not influence platelet function. Results control of capillary haemorrhages and for correction of drug induced bone marrow depression.

Uterotonic activity: The uterotonic activity of vasicine was investigated in details on the uteri of different species of animals and in different hormonal states both *in vitro* and *in vivo*. Its uterotonic activity was found to be similar to that of oxytocin and methyl ergometrine. It was observed that the uterotonic activity of vasicine was influenced by the degree of priming of the uterus by oestrogens (known to enhance the synthesis of prostaglandins in the uterus) and it was markedly reduced after pretreatment of the uterus with aspirin and indomethacin. This indicated that the uterotonic effect of vasicine was atleast partly medicated through the release of prostaglandins.

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NB: Additional informotions on this medicinal plant are given by Lekshmi R Nath et al in the next section of this chapter.

5. AEGLE MARMELOS (L) CORREA EX ROXB.

Common name: Koovalum

Chemical constituents: The pulp contains mucilages, pectin, sugar, tannins, volatile oils, bitter principles, ash etc. Fresh leaves on distillation yields green oil with a peculiar aromatic odour, Marmelosin. The fruit pulp contains marelosin, which is considered to be the most important active principles of the fruit. The seeds gave a light yellow oil which possess very good purgative properties.

Parts used: Fruits (both ripe and unripe), roots, bark, leaves, rind of ripe fruits and flowers are used in Ayureveda, Siddha and Yunani. It is one of the ingredient in the 'Dasamoola', ten roots used in Ayurveda.

The leaves of Bael are astringent, a laxative, and an expectorant and are useful in treatment of ophthalmia, deafness, inflammations, cataract, diabetes, diarrhoea, dysentery, heart palpitation, and asthmatic complications (1). It has been claimed that the leaf of Aegle marmelos posses contraceptive efficacy (2). Fresh aqueous and alcoholic leaf extracts of Aegle marmelos were reported to have a cardio tonic effect in mammals (3). Aegle marmelos leaf extract has been reported to regenerate damaged pancreatic beta cells in diabetic rats (4). and increased the activities of peroxidase in the liver tissues of isoproterenol treated rats (5). An aqueous decoction of the leaves has been shown to possess a significant hypoglycemic effect (6). Aegle marmelos leaf extract was found to be a potential antioxidant drug, which reduces the blood sugar level in alloxan induced diabetic rats (7). It was found to be as effective as insulin in the restoration of blood glucose and body weight to normal levels on hyperglycemic state (8). The ethanolic extract of Aegle marmelos leaf possesses anti spermatogenic activity (9). and aqueous extract of the leaf has anti motility action on spermatozoa in rats.

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Pharmacological effects

Considering the diverse medicinal properties of Aegle marmelos, the present study was under taken to evaluate the hepatoprotective effect of Aegle marmelos in alcohol induced liver injury in experimental animal models

The Hepatoprotective Effect of Bael Leaves (Aegle Marmelos) in Alcohol Induced Liver Injury in Albino Rats

Vinodhini Singanan, Malairajan Singanan and Hazeena Begum

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Herbal drugs are traditionally used in various parts of the world to cure different diseases. The Ayurvedic and Siddha medical systems are very famous medical practices in Indian traditional medicines. In the present research studies, Bael leaves (Aegle marmelos, family of Rutaceae) which are also called as Bilva in ancient Sanskrit was used as herbal drug and its hepatoprotective effect in alcohol induced liver injury in albino rat was evaluated using essential biochemical parameters. The experiments were performed with four groups of animals. The experimental animals were administered with 30% ethyl alcohol for a period of 40 days and the fine crude plant leaves powder was fed to animals for next 21 days. The observed values of TBARS (Thiobarbituric acid reactive substances) in healthy, alcohol intoxicated and herbal drug treated animals were 123.35, 235.68 and 141.85 µg/g tissue respectively. The results were compared with the standard herbal drug silymarin (133.04 µg/g tissue). The experimental results indicate that, the Bael leaves have excellent hepatoprotective effect.

Anti diabetic activity of Aegle marmelos and its relationship with its antioxidant properties

M.C.Sabu and Ramadasankuttan

Indian J Physiol Pharmacol 2004; 48 (1): 81–88

Oxidative stress induced by alloxan has been shown to damage pancreatic β-cell and produce hyperglycemia in rats. Aegle marmelos leaf extract is being used in Ayurveda as a medicine for diabetes. The present study examined the action of Aegle marmelos against experimental diabetes as well as the antioxidant potential of the drug. A methanolic extract of Aegle marmelos was found to reduce blood sugar in alloxan diabetic rats. Reduction in blood sugar could be seen from 6th day after continuous administration of the extract and on 12th day sugar levels were found to be reduced by 54%. Oxidative stress produced by alloxan was found to be significantly lowered by the administration of Aegle marmelos extract. This was evident from a significant decrease in lipid peroxidation, conjugated diene and hydroperoxide levels in serum as well as in liver induced by alloxan. Catalase and glutathione peroxidase activity in blood and liver were found to be increased from 9th day onwards after drug administration. Superoxide dismutase and glutathione levels were found to be increased only on 12th day. These results indicate that Aegle marmelos extract effectively reduced the oxidative stress induced by alloxan and produced a reduction in blood sugar.

6. ALANGIUM LAMARCKII THW

Syn. *A. decapetalum, A. tomentosum, A. hexapetalum*

Common name: Ankolam, Chemmaram

Parts used: Root, root bark, seeds and leaves

Alangium salvifolium (Linn.f.) Wang. (Family Alangiaceae,) syn. Alangium lamarckii Thw. is a common tree growing in India. It is known as Sageleaved alangium in English. Ankola, Akoda, Dhera in Hindi, Ankota in Sanskrit and and Aliñcil in Tamil. It is a small tree growing up to 10 meter in height, with more or less spinescent branches; stem bark pale brown colored with shallow cracks; young parts pubescent; root yellow, strong with brown bark.[1,2] The tree is widely distributed throughout India, Ceylon, South China, Malaya, Philippines. The plant flowers during February to April and bears

fruits during May – August.[3,4] Root bark of this tree is bitter, purgative, anthelmintic, astringent, pungent, efficacious in leprosy, has emetic properties and useful in fever, skin diseases and as a purgative, antipoisonous against rat, snake and insect bites, antipyretic, anti-inflammatory, analgesic, diuretic, anthelmintic, antidiarrhoeal, useful in insanity, epilepsy, biliousness, syphilitic and other skin diseases, antihemorrhagic, expectorant in cold and cough, rabies, jaundice and hepatitis and effective remedy for blood disorders.[5,6] In the Siddha system of medicine it is used in the preparations of Pataic Cankāran and Ayapirunka Rāja Karpam.[7] Root bark of A. salvifolium is reported to contain alangine A, alangine B, alanginine, ankoline, lamarkine, emetine, cephaeline, psychotrine, tubulosine, alangicine, desmethylpsychotrine, desmethyltubulosine, myristic, palmitic, oleic, linoleic acids, myricyl alcohol, stigmasterol and β-sitosterol.[8-13] As there is no detailed pharmacognostical data reported on the root bark of this plant, present study attempts to develop pharmacognostical data on the drug essential for its standardization and authentication.

Phytochemistry: All the extracts showed the presence of steroid. Chloroform extract showed the presence of phenol and alkaloid. Ethyl acetate and alcohol extracts showed the presence of flavonoid, phenol, tannin and alkaloid and did not answer for quinone, coumarin, iridoid and terpenoids.

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7. ALEURITES MOLUCCANA

Syn. *A. triloba*

Common name: Indian walnut

Habitat: This is a native of Malaya. Found wild in many parts of South India

Constituents: Kernel contains cellulose, fat, organic matter, mineral matter etc. seeds yield a fixed oil which contains oleine, myristin, palmitin and stearin

Parts used: Nuts and seed oil

The study of (1) this plant belongs to the Euphorbiaceae family, which includes 300 genera and about 7000 species. A. moluccana has been extensively used in folk medicine for the treatment of ulcers, headache, fevers, diarrhea and hypocholesterolemia (2) Chemically, some workers have isolated hydrocarbons, sterols, flavonoids and triterpenes, which have contributed to the analgesic activity of the leaves in previous reports (3,4)

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Anti-inflammatory and antipyretic activity of aleuritis moluccana leaves Junaid Niazi , Vikas Gupta , Prithviraj Chakarborty , Pawan Kumar

Asian Journal of Pharmaceutical and Clinical Research Vol.3 Issue 1, PP 35-37

Aleurites moluccana (euphorbiaceae) has been extensively used in folk medicine for the treatment of ulcers, headache, fevers, diarrhea and hypocholesterolemia. Sterols, flavonoids and triterpenes have been isolated from the leaves of the plant. The methanolic extract of dried leaves of aleurites moluccana (AMME) was investigated for anti-inflammatory (carragenan induced rat paw oedema) and anti-pyretic (brewer's yeast induced pyrexia) activities. Pre-treatment with the extract (100 - 300 mg/kg, p.o.) significantly prevented increase in volume of paw oedema in dose dependent manner. A maximal effect was observed at 300 mg/kg which was comparable to diclofenac (20 mg/kg, orally). Ceiling effect at the dose of 300 mg/kg was observed. The anti-pyretic effect of AMME (measured as % reduction in body temperature) was compared with paracetamol (150 mg/kg, orally). AMME in dose of 300 mg/kg caused significant decrease in body temperature of rats. In conclusion, this study has established the anti-inflammatory activity and antipyretic activity of aleurites moluccana and thus, justifies the ethnic uses of the plant.

Hypolipidaemic activity of methanol extract of Aleurites moluccana.

R C Pedrosa, C Meyre-Silva, V Cechinel-Filho, J C Benassi, L F S Oliveira, V Zancanaro, J Dal Magro, R A Yunes

Phytother Res. 2002 Dec; 16 (8):765-8

The lipid-lowering action of the leaves of the Aleurites moluccana methanol extract was studied in Triton W-1339 and high-fat-diet fed rats. The serum lipids (total cholesterol, LDL- and HDL-cholesterol and triglycerides) and body weight were found to be lowered by A. moluccana (300 mg/kg, b.w.) in rats with Triton-induced hypercholesterolaemia and on a hyperlipaemic diet. The results suggest that the lipid lowering action of this natural product is mediated through inhibition of hepatic cholesterol biosynthesis and reduction of lipid absorption in the intestine

8. ALLIUM CEPA Linn

Family: Alliaceae

Genus: Allium

Species: A. cepa

Common names: Pyaj (Hindi). Vengayam (Tamil). Ully (Malayalam)

Edible Parts: Flowers, Leaves, Bulbs, Seeds.

Chemical constituents: Onion has been found to contain flavanoids like quercetin, quercetin-3-glucoside, isorhamnetin-4-glucoside and sugars viz; xylose, galactose, glucose, fructose, mannose etc, organosulfur compounds, allylsulfoxides, flavenols, S-alk(en)yl cysteine sulfoxides, cycloalliin, selenium, thiosulfinates, various sulfides and seleno cysteine derivatives. (Detailed references on allium compounds in garlic and onion are given in part II of this book)

Pharmacological actions: Flavonoids and organosulfur compounds are the two major classes of secondary metabolites found in onions believed to promote beneficial health effects. The organosulfur compounds are believed to possess anti-inflammatory, anti-allergic, anti-microbial, and anti-thrombotic activity by inhibition of cyclooxygenase and lipoxygenase enzymes. Most likely the compounds work through sulfur-sulfur or sulfur-oxygen linkages (1). These compounds are formed when an onion is cut and the cell walls are disrupted. Allinase enzymes produce sulfenic acids via S-alk(en)yl cysteine sulphoxides (ACSOs) which rearrange to various compounds such as thiosulfinates, cepaenes, and onion lachrymatory factor. (2). See the articles on onion and dietary garlic sulfoxide compounds that prevent blood clotting problems. In Role of dietary fibers and nutraceuticals in preventing diseases (2009) P. 225-242 & 313-326. By Dr. K.T. Augusti et al. Pharma Med. Press. Hyderabad. 500095.

Cancer

Organosulfur compounds such as diallyl disulfide (DADS), S-allylcysteine Sulfoxide (SACS), and S-methylcysteine Sulfoxide (SMCS) present in large amount in garlic and scarcely in onion have been shown to inhibit colon and renal carcinogenesis (3). Mechanisms of protection ranged from induced cancer cell apoptosis and gene transcription inhibition to protection against UV-induced immunosuppression (4).

Diabetes

The organosulfur compounds present in alliums viz; S-methylcysteine sulfoxide (SMCS), S-allyl and S-propenylcysteine sulfoxides (SACS, SPCS) were linked to significant amelioration of weight loss, hyperglycemia, low liver protein and glycogen, and other characteristics of diabetes mellitus in rats (5). *In vivo* analysis of the effects of quercetin on human diabetic lymphocytes showed a significant increase in the protection against DNA damage from hydrogen peroxide at the tissue level (6). Further human studies should assess the ability of a high flavonoid diet to attenuate diabetic conditions.

Coronary Heart Disease

Inhibition of LDL (cholesterol rich lipo protein)*/ oxidation and platelet aggregation were proposed as mechanisms of benefit against cardiovascular disease (7). Quercetin exerts its beneficial effects on cardiovascular health by antioxidant and anti-inflammatory activities (8, 9). Adenosine and paraffinic polysulfides (PPS) are compounds isolated from onions with purported antiplatelet effects (10,1,11). However, other research suggested that the protective effects of quercetin occur at the cellular level. Nègre-Salvayre and Salvayre (1992) found that the flavonoid protected cells from the cytotoxic effects of previously oxidized LDL. They suggested the mechanism of action was blocking of the intracellular transduction of the cytotoxic signal. Uchida et al. (1999) noted inhibition of transduction signals by quercetin on the lipid peroxidation-derived oxidative stressor 4-hydroxy-2 nonenal (HNE). Strokes and coronary heart disease can be caused by platelets in the blood adhering to the walls of blood vessels in the heart or brain and aggregating to the point of obstruction (12). Research on *in vivo* effects of onion consumption in rats showed significant inhibition of serum thromboxane, an inducer of platelet aggregation, levels with high doses (500mg/kg) (13). Low doses (50mg/kg) showed little effect, but a benefit was proposed over long term consumption. Boiled onions, even at the high dosage level, showed no effect, suggesting degradation of effective compounds due to high temperatures.* LDL= Low density lipoprotein (bad chole.) Onion and garlic compounds prevent blood clotting in our heart and blood vessels.

HIV

Suppression of human immunodeficiency virus type 1 (HIV-1) replication is a target for anti-AIDS drugs. Viral protein R (*vpr*) has been shown to control the rate of replication of HIV-1 (14). Therefore,

suppression of this gene is a probable target for inhibition of the development of AIDS. Westervelt et al. (1992) showed that disruption of the functionality of the *vpr* gene attenuated HIV-1 replication. It was also shown that quercetin may diminish virus replication by inhibiting *vpr* function (15). At 10μM dosage, quercetin provided 92% inhibition of *vpr*-induced cell cycle abnormality

Antibacterial/Antifungal

Organosulfoxides (allicin type compounds) were cited as protective agents against microbes by researchers who found that they are antibacterial in effects viz; onion extract acts against oral pathogenic bacteria (16). Thiosulfinates formed from onion tissue degradation (i.e. chopping) have been credited in inhibition of arachidonic acid metabolic pathways and subsequent anti-inflammatory and antiasthmatic effects (17).

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Antifertility Activity of Ethanolic Extract of Allium cepa Linn in Rats
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In the present study, antifertility activity of ethanolic extract of *Allium cepa Linn* was evaluated. The ethanolic extract of *Allium cepa* showed significant antifertility activity Pretreatment with ethanolic extract showed significant inhibition of number of implant site at a dose of 300 mg/kg. There was no change in ovulation, hence the antifertility activity observed in the present study with *Allium cepa* can be attributed largely to its antiimplantation activity. Presence of chemical constituents in *Allium cepa* like Kampferol, _-sitosterol, ferulic acid, myristic acid, prostaglandins and these constituents might be responsible for antiimplantation activity. Loss of implantation caused by *Allium cepa ethanolic extract* may be due to antizygotic or blastocytotoxic activity.

Antioxidative Effects of Allium Cepa Essential Oil in Streptozotocin Induced Diabetic Rats

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This study was undertaken to investigate the antioxidative effect of allium cepa essential oil in streptozotocin induced diabetic albino rats through assessment of the lipid peroxidation, serum lipid profile, blood glucose and serum insulin, in addition to histoliogical and histochemical study of liver and kidney. Diabetes mellitus was induced in 20 out of 30 adult male albino rats, using subcutaneous injection of 60 mg/kg b.w. streptozotocin. Diabetic rats were divided into two groups, one group was given onion essential oil orally (100 mg/kg b.w.) for 21 days (treated group). The other group received no onion oil. The remaining normal rats (negative control group) received neither streptozotocin nor the onion essential oil.It was found that treatment with onion essential oil, resulted in a significant decrease in serum lipids, lipid peroxide formation, blood glucose and increase in serum insulin.The control diabetic group not fed with the extract showed no change in their blood parameters or amelioration in histopathological studies. All the histological differences caused by diabetes were reversed to normal in the treated group. They suggest here that the mode of action of allium cepa (onion) as an antidiabetic agent may be due to the antioxidant properties of its essential oil components thereby preventing hyperglycemia and reducing lipid profile together with ameliorating liver and kidney pathological conditions caused by diabetes to normal pattern.

9. ALLIUM SATIVUM LINN(GARLIC)

Latin Name : Allium sativum

Family : Liliaceae

Common Names : Lasun (hindi), Vellappoodu (Tamil),Vellully (Malayalam) Rasona, Arista, Lasuona (Sanskrit Name)

Parts Used : Bulbs and leaves.

Garlic is one of the bulbous perennial food plant of the family Alliaceae and Alliun genus. "Allium," the ancient Latin name for garlic, is derived from the Celtic all, signifying hot or burning. The species name "sativum" means planted, cultivated or sown (not wild). The word comes to us from Old English gārlēac, meaning “spear leek”. Because of its wide cultivation, its origins are uncertain, it has been traced to both southwest Siberia and Sicily, where it grows wild [1]. The domesticated garlic plant does not produce seeds, but it grows from bulbs. The segments of bulbs are usually called “cloves” by chefs, are the part of the plant most commonly eaten. The bulb has a strong and characteristic odour and an acrid taste, and when pure, yields an offensively smelling oil, the essence of garlic. This is mainly caused by the presence of sulphur containing volatiles, [2] identical with allyl sulfide ($C_6H_{10}S_2$). Garlic is widely used in many forms of cooking for its strong flavour, which is considered to enhance many other flavours. In pharmaceutical

industry, garlic is much used due to its antioxidation, antimicrobial, anticarcinogenic, antithrombotic, and antiplatelet- aggregating properties [3]. Onion and garlic consumption increases good chol. (HDL) and lower bad chole. (LDL) in blood.

Chemical Constituents

Garlic differs from most other sources of essential oils. In this case, the fragrance producing bulb must be crushed before the volatile compounds are released. Theodor Wertheim, a German chemist was the first to carry out a chemical study of garlic. In 1844, he extracted garlic oil from garlic by steam distillation. He named the group CH_2=CH-CH_2- as allyl. Semmler in 1892 identified the principal component of the oil as diallyl disulfide [3]. Before garlic is crushed, the intact cell contains alliin or S-alyll-Lcycteine S-oxide. Within the cell there are vacuoles that contain an enzyme known as alliinase. When the cell is crushed, the enzyme is released. Alliin and alliinase combine through enzymatic reaction to produce allicin or S-propene-1-(allyl) sulfinothioc acid and some S-2-propenyl ester; thio-2-propene-1-sulfinic acid S-allyl ester or diallyl thiosulfinate [4]. Allicin itself is just a transient compound which will rapidly decompose and poymerize to other compounds like poly sulphides or ajoene [4]. Allicin has been described as an odoriferous, unstable antibacterial substance that polymerized easily and must be stored at low temperature. When heated, it breaks down to give a variety of compounds. A great deal of progress has been made in recent years in identifying the various organosulphur compounds formed. Continuing the investigations, Block and his coworkers proved that the decomposition of the unstable allicin proceeds by several pathways. According to one of them, it self- decomposes, giving the 2-propenesulfenic acid and thioacrolein . The self-condensation of 2-propenesulfenic acid regenerates a molecule of allicin; the self-condensation of two molecules of thioacrolein, yields two types of cyclic compounds by Diels-Alder reaction. They were identified as 2- vinyl-[4H]-1,3-dithiin (major) and 3-vinyl-[4H]-1,2-dithiin (minor) . The cyclic dithiin will thermally decompose to various acyclic molecules similar to those found in garlic distilled oil. Some of the acyclic molecules found in distilled garlic oil are dially disulfide, 2-propenesulfenic acid , thioacrolein, 2-vinyl-[4H]-1,3-dithiin, 3-vinyl-[4H]-1,2-dithiin, diallyl hexasulfide , dially monosulfide, allyl methyl disulfide, diallyl tetrasulfide, ally methyl trisulfide , diallyl trisulfide, 1-propenesulfenic acid, dipropyl sulfide, dipropyl disulfide, allyl mercaptan, and methallylsulfide, dimethyl disulfide [5].

Pharmacological activity:

Atherosclerosis and lipid metabolism

Protective effect of garlic on atherosclerosis has been attributed to its capacity to reduce lipid content in arterial wall. Garlic causes direct antiatherogenic (preventive) and antiatherosclerotic (causing regression) effects at the level of artery wall. Garlic depressed the hepatic activities of lipogenic and cholesterogenic enzymes such as malic enzyme, fatty acid synthase, glucose-6 phosphate dehydrogenase and 3-hydroxy-3-methyl-glutaryl-CoA (HMG CoA) reductase. Garlic also increased the excretion of cholesterol, as manifested by enhanced excretion of acidic and neutral steroids after garlic feeding. LDL isolated from human subjects given AGE (aged garlic extract) or aqueous garlic extract was found to be significantly more resistant to oxidation than that collected from control subjects. These data indicate that suppressed LDL oxidation may be one of the powerful mechanisms accounted for the benefits of garlic in atherosclerosis Allicin was identified initially as the active compound responsible for antiatherosclerotic effect. However, recent in vitro studies revealed that water-soluble organosulfur compounds, especially S-allyl cysteine (SAC), present in aged garlic extract and diallyl-di-sulfide (DADS), present in garlic oil are also potent inhibitors of cholesterol synthesis (6). Allicin works as an antibiotic and destroys virus that spread jaundice and chikungunya. Always add onion and garlic in our food daily so as to protect our body from corona, jaundice etc. All hypo cholesterolenic agents prevent atherosclerosis that leadsto CHD. Eg. Polysulfoxides.

Platelet aggregation

The antiplatelet mechanism of garlic is much more established than its any other biological effects. Aqueous extract of garlic inhibited platelet aggregation induced by ADP, collagen, arachidonate, epinephrine and calcium ionophore A23187 in a dose-dependent manner. It was found that garlic reduced the formation of thromboxane, inhibited the phospholipase activity and lipoxygenase products formed in

platelets. These effects may explain, in part, inhibition of platelet aggregation. Further, since garlic was also effective in inhibiting aggregation induced by calcium ionophore A23187 it may be suggested that the antiaggregation effect may be related to intraplatelet mobilization of calcium. Inhibition of epinephrine-induced aggregation by garlic extract may suggest that it may be inhibiting uptake of calcium into platelets thereby lowering cytosolic calcium concentrations. In regard to a specific mechanism of ajoene's antiplatelet action, several suggestions have been made. Ajoene strongly inhibits the metabolism of arachidonic acid by both cyclooxygenase and lipoxygenase pathways, thus inhibiting the synthesis of thromboxane A2 and 12-HETE. Antiaggregatory effect of ajoene may also be causally related to its direct interaction with the putative fibrinogen receptor (GPIIb/IIa). The studies of Jamaluddin et al (1988) demonstrated that ajoene interacts with a purified hemoprotein implicated in platelet activation. Ajoene modifies the binding of the hemoprotein with ligands deemed to be physiologically relevant as effectors. Allicin inhibits human platelet aggregation in vitro without affecting cyclooxygenase or thromboxane synthase activity or cyclic adenosine monophosphate (AMP) levels. Allicin also inhibits platelet aggregation but does not alter the activity of vascular prostacyclin synthase. However, it inhibits ionophore A23187-stimulated human neutrophil lysosomal enzyme release. Thus garlic appears to be in possession of components which might exert their effects at various stages involved in the process of platelet aggregation (2,6).

Blood pressure lowering effect

Rashid and Khan (1985) have postulated that mechanism of antihypertensive action of garlic is due to its prostaglandin like effects, which decreases peripheral vascular resistance. The gamma-glutamylcysteines are the compounds in garlic that may lower blood pressure, as indicated by their ability to inhibit angiotensin-converting enzyme in *in vitro.* Garlic modulates the production and function of both endothelium derived relaxing and constricting factors and this may contribute to its protective effect against hypoxic pulmonary vasoconstriction. Garlic elicits nitric-oxide-dependent relaxation in pulmonary arteries. This hypothesis was explained by the fact that NG-nitro-L-arginine methyl ester (L-NAME, a NOS inhibitor) abolished the vasodilatory effect of garlic. But another study reported that pulmonary vasodilatory effect of allicin are independent of the synthesis of NO, ATP-sensitive (K+) channel, activation of cyclooxygenase enzyme (7).

Anti diabetic action

Though the exact mechanism/s of garlic as antidiabetic agent is still not clear but *in-vivo* as well as *in-vitro* studies showed that garlic acts as an insulin secretagogue in diabetic rats. Augusti & Sheela also proposed that antioxidant effect of S-allyl cysteine sulfoxide (isolated product from garlic) may also contribute for its beneficial effect in diabetes. Another proposed mechanism is due to spare insulin from sulphydryl group. Inactivation of insulin by sulphydryl group is a common phenomenon. Garlic (allicin) can effectively combine with compounds like cysteine and enhance serum insulin. Jain & Vyas proposed that garlic can act as an antidiabetic agent by increasing either the pancreatic secretion of insulin from the beta cells or its release from bound insulin (8). Other mechanisms are also suggested by Augusti etal (9) viz; anti oxidant, hypolipidemic, health promoting and such other ameliorating effects of garlic oil in addition to its insulin sparing and promotion of its secretion may account for the anti diabetic effects of garlic oil.(More details are given in part II of this book on the action of allium principles)

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AMELIORATED EFFECTS OF ALLIUM SATIVUM ON SUBCLINICAL LEAD TOXICITY IN GOATS

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Pakistan Vet. J., 2006, 26(4): 184-186.

The prophylactic efficacy of garlic (Allium sativum) to reduce tissue lead (Pb) concentration was evaluated experimentally in goats. Eight crossbred Iranian female goats were divided into two equal groups. Goats of group A received lead acetate orally at the dose rate of 80 mg/kg BW and group B received concurrent lead acetate orally at the dose rate of 80 mg/kg BW and dried garlic powder orally at the dose rate of 45 g/animal/day for 5 days. Mean serum lead concentration in group A goats was 0.13 ± 0.03 µg/ml before lead administration and 0.56 ± 0.04 µg/ml on 5th day, whereas in group B the concentration was 0.11 ± 0.02 µg/ml before treatment and 0.29 ± 0.02 µg/ml on the 5th day. Mean urine lead concentration in group A ranged between 0.05 ± 0.02 µg/ml before lead administration and 0.45 ±0.07 µg/ml on the 5th day, whereas in group B it was 0.07 ± 0.01 µg/ml before treatment and 4.08 ± 0.93µg/ml on the 5th day. The mean lead concentrations in bones, lungs, heart, liver, kidneys and skeletal muscles of group A following necropsy were 39.95 ± 6.94, 0.65 ± 0.06, 0.46 ± 0.07, 6.61 ± 0.74, 19.32 ±2.17, 0.27 ± 0.06 µg/g of wet tissue, respectively. The respective values in groupB were 17.77 ± 4.12, 0.20± 0.04, 0.20 ± 0.02, 1.45 ± 0.30, 2.37 ± 0.27 and 0.11 ±0.01µg/g of wet tissue. Thus, concurrent use of lead acetate and garlic dry powder reduced lead concentration considerably, indicating the potential activity of garlic against lead toxicity in goats.

Garlic Oil and Vitamin E Prevent the adverse Effects of Lead acetate and Ethanol Separately as well as in Combination in the drinking water of Rats.

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Indian J.Clin.Biochem. 25(3) 2010, 280-288

Daily feeding of drinking water containing lead acetate (160mg/L) or 10% alcohol by volume or a combination of both to rats for a month produced certain deleterious effects through oxidative stress. Both heavy metal lead and alcohol are capable of doing such damages. The deleterious alterations observed were in the parameters of blood, serum and tissues, viz; Hb,Pb, proteins, lipids, lipid per oxidation, Vitamins C and E levels and enzyme activities of AST, ALT, and catalase. Simultaneous feeding of either of the two antioxidants garlic oil (G.O) and vitamin E at equal doses of 100mg / kg /day, to the rats counteracted the deleterious effects of the above two chemicals significantly. The maximum damage was brought about by feeding of drinking water containing both lead acetate and alcohol. The protective effects of G.O and Vitamin E were not significantly different. The mechanism of actions of the Vitamin E and G.O is probably due to their efficiency as detoxifying agents and antioxidants, to scavenging free radicas as wellas an independent action of G.O on the removal of lead salt as lead sulfide.

Hepatoprotective and some haematological effects of Allium sativum and vitamin C in lead-exposed wistar Rats

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The hepatoprotective and some haematological effects of Allium sativum (Garlic) and vitamin C were studied on experimental rats that were exposed to lead (Pb) for one week. Twenty – four female Wistar rats were divided into four groups of six rats per group. Rats in group A were kept as the control. Rats in groups B, C and D were exposed to 100 µmol/kg body weight of lead acetate intraperitoneally for seven days. Garlic diet (200 g minced garlic/kg diet) and vitamin C (500 mg/kg body weight) were given to rats in groups C and D for additional seven days respectively. Garlic and vitamin C produced significant reduction at $p < 0.05$ in the levels of ALT, ALP and PCV while the level of AST increases significantly at $p < 0.05$. The level of Hb increases significantly at $p < 0.05$ in rats treated with garlic and reduces significantly at $p < 0.05$ in rats treated with Vitamin C. This study, therefore suggests that garlic and vitamin C have some hepatoprotective and haematological effects.

Antiproliferative Effects of Allium Derivatives from Garlic

John T. Pinto and Richard S. Rivlin

Journal of Nutrition. 2001; 131:1058S-1060S

There is increasing evidence that allium derivatives from garlic have significant antiproliferative actions on human cancers. Both hormone-responsive and hormone-unresponsive cells lines respond to these derivatives. The effects shown by allium derivatives include induction of apoptosis, regulation of cell cycle progression and modification of pathways of signal transduction. Allium derivatives appear to regulate nuclear factors involved in immune function and inflammation, as well as in cellular proliferation. Our own studies indicate that allium derivatives inhibit proliferation of the human prostate cancer cell line (LNCaP) and the human breast cancer cell line (MCF-7). Further research is required to clarify the mechanisms of inhibition of cellular proliferation by allium derivatives and to explore their potential application to cancer prevention and control.

10. BACOPA MONNIERA (L) Wettst

Common name: Brahmi

Parts used: whole plant. Active chemical components are mentioned.

Bacopa monnieri is a creeping, glabrous, somewhat succulent herb growing in wet places. The plant is called Aindri and Brâhmî in Sanskrit (1). Brahmi is also known as "Medhya Rasayana" in Ayurveda as it increases mental clarity and brain stimulating action (2). It also possessess anti-inflammatory, analgesic, antipytretic, epilepsy, insanity, anticancer and antioxidant activities (3-7). It is also used in the treatment of asthma, hoarseness, water retention and blood cleaning. Moreover, leaf juice of brahmi is given to children for relief in bronchitis and diarrhoea.The medicinal properties of Bacopa monnieri responsible for improving memory-related functions have been attributed to the presence of different types of saponins such as bacosides A, B, C and D which are the active triterpenoid principles and known as "memory chemicals" (8). These compounds are attributed with the capability to enhance the transmission efficiency of nerve impulses, thereby strengthening memory and cognition (9). A triterpenoid viz; Betulinic acid was isolated from Bacopa by Viji Vijayan, Helen et al. in 2010 and its pharmacological actions were studied. It inhibited endoxin stimulated phosphorylation cascade and proinflammatory prostaglandin E2 production in human peripheral blood mononuclearcells (British Jour. Pharmacol. Accepted for publication 2010) It also supprresed lipopolysaccharide stimulated interleukin-6 production of Nuclear fraction-kB in peripheral blood mononuclear cells (10).

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Antibacterial efficacy of Bacopa monnieri leaf extracts against pathogenic bacteria

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Background: Bacopa monnieri (Linn) Pennell (Scrophulariaceae) is widely distributed in tropical regions of Asia, and used in the treatment of cough or as an antiseptic. The traditional use of this plant suggests its possible antibacterial properties, but its efficacy has not been examined yet.

Objective: Evaluate the antibacterial efficacy against pathogenic bacteria using the disk diffusion method.

Materials and methods: Five different concentrations (500 µg, 1, 2, 5, 10, and 15 mg/mL) of crude leaf extracts of

Bacopa monnieri (L.) Pennell were tested for antibacterial efficacy against seven Gram-positive and 11 Gramnegative bacteria. The sensitivity of plant fractions was tested using the disk diffusion method.

Results: Maximum activity was revealed by ethyl acetate and methanol extracts, followed by aqueous, benzene, and petrol extracts. Phyto-chemical analysis of the plant leaf showed the presence of alkaloids, flavonoids, and saponins.

Conclusion: This plant may be effective for treatment of different pathogenic diseases.

NB: Additional informotions on this medicinal plant are given by Lekshmi R Nath et al in the next section of this chapter.

11. BALSAMODENDRON MYRRHA, NEES

Syn. Commifera myrrha

Common name: Myrrh

Parts used: Resinous exudates of the bark

Commiphora myrrha is a sturdy, spiny, glabrous shrub or small tree, usually with a distinct short trunk up to 4 m tall. Outer bark silvery, whitish or bluish grey, peeling in large or small papery flakes from the greener under-bark; exudate hardly scented, viscid, producing a hard translucent yellowish gum-resin.

Chemical Composition.—Myrrh is composed of gum, 40 to 60 per cent, insoluble in alcohol; resin, about 27 to 40 per cent, soluble in alcohol, and volatile oil, 2.18 per cent, (Ruickholdt); 7 to 8 per cent, (O. Köhler, 1890). Upon incineration, myrrh leaves about 3.5 per cent of ash, principally calcium carbonate. O. Köhler (Archiv der Pharm., 1890, p. 291) found 57 to 59 per cent of gum which was ascertained to be a carbohydrate of the formula $C_6H_{10}O_5$. The resins (myrrhin and myrrhic acid, of

Ruickholdt) were separated by Köhler into an indifferent resin ($C_{26}H_{34}O_5$). soluble in alcohol and ether, and having three replaceable hydroxyl groups, and two dibasic resin-acids. The essential oil (myrrhol, or myrrhenol of older observers) contains a volatile compound ($C_{10}H_{14}O$) not identical with thymol or carvol. The volatile oil of myrrh is laevo-rotatory. When exposed to air and light, it resinifies by oxidation and acquires the appearance and consistence of myrrh. Formic acid is said to be developed in this process

Action, Medical Uses, and Dosage.—Myrrh is stimulant, especially to mucous tissues. It also exerts an antiseptic influence, and is used to promote expectoration, as well as menstruation. It has also been used as a vermifuge. Internally, the smaller doses promote digestion. Large doses accelerate the pulse, augment the heat of the body, cause gastric heat and burning, great sweating and marked prostration; occasionally it causes nausea, vomiting, and purgation. It is not antispasmodic, and is contraindicated in internal inflammations. It is generally used in enfeebled conditions of the body, and has been found useful in cases of excessive mucous secretion, as in gleet, chronic gonorrhoea, and chronic catarrh; also in laryngitis, bronchitis, humoral asthma, and other diseases of the air-tubes accompanied with profuse secretion, but expelled with difficulty. Its property of restraining the mucous discharges is observed to be most pronounced upon the renal and bronchial tract. As an expectorant, it acts best by combining it with such agents as squill, giving to both an increased force possessed by neither alone. Chronic respiratory disorders are the cases for its exhibition, it being indicated in chronic bronchitis with unhealthy and exhausting secretions, relaxed mucous tissues, and difficulty in raising the sputa. It is contraindicated by arterial excitement or fever. For use in the above condition, the following combination, an excellent alterative expectorant and stimulating tonic, is recommended by Prof. Locke: Rx Syr. prunus virg., syr. senega, aa flʒij; Comp. tinct. of myrrh and capsicum flʒii. Mix. Sig. Teaspoonful every 3 hours. The same may also be used in the asthma of the aged. Cough and expectoration are lessened, the secretions reduced in quantity, and the consequent exhaustion incident to profuse expectoration prevented. Besides, it acts kindly on the stomach, and otherwise sustains the strength of the patient.

Myrrh has some reputation as an emmenagogue. It is adapted to female disorders accompanied with weight, dragging, and leucorrhoea. It is reputed useful in suppressed menses, and in some cases of anemia. In either instance, however, it is not efficient unless exhibited with some form of iron, aloes, etc. Locke recommends for amenorrhoea, and particularly if the uterine torpor be associated with constipation, the following prescription: Rx Pulv. myrrh, grs. xxx; aloes, grs. x; macrotin, grs. x. Mix. Make 20 pills. Sig. Dose, 1 or 2 pills three times a day.

Myrrh is of value in chronic gastritis and atonic dyspepsia with full, pallid tongue and mucous tissues, and with frequent, mucous alvine discharges accompanied with flatulence. Here myrrh and gentian act well, and if nervous symptoms are prominent, an equal quantity of valerian may be used with them. The dose of the combination of equal parts of these tinctures is from 5 to 20 drops. Chronic mucous fluxes, from the bowels or urinary tract, are benefited by myrrh.

Myrrh was formerly used as a dressing for indolent ulcers to promote granulation and alter the character of the discharges. It was at the same time given internally also. Topically, it is a very useful application to indolent sores, gangrenous ulcers, and aphthous or sloughy sore throat, spongy or ulcerated conditions of the gums, caries of the teeth, etc. In chronic pharyngitis, with tumid, pallid membranes, elongated uvula, and spongy, enlarged tonsils, it is an exceedingly useful topical agent. It overcomes the bad breath of dyspeptics and scorbutics. It is sometimes combined with hydrastis and capsicum, in aphthae. The dose of myrrh, in powder or pill, is from 5 grains to I drachm; of the tincture, from 20 drops to 2 fluid drachms.

12. BASSIA LATIFOLIA

Syn. Madhuca longifolia

Family: Sapotaceae

Common name: Iruppa

Habitat: Bombay presidency, central provinces, Bengal and south Indian forests and Ceylon

Constituents: Saponin, albumen, tannin

Parts used: Flowers, fruits, seeds and bark

Literature on Siddha medicine mentions 3 types of 'Illuppai' (Tamil vernacular name for Madhuca sp.) namely 'Illuppai', 'Seemaiillupai' (exotic) and 'kaattuilluppai' (wild). Madhuca sp. is medicinally and commercially useful. The plant parts like stem bark, corolla lobes, seeds and seed oil are used in diabetes, burns, scalds, bronchitis, rheumatism, cough, piles, galactagogue skin diseases, tonsillitis, stomach-ache, aphrodisiac and respiratory diseases and have laxative, insecticidal and piscicidal properties . Dolui (1988 a and b) found that the fat prepared from oil of Madhuca sp. is a promising suppository base in drug preparation. The oil of M indica is one of the ingredients of 'Kubja Prasavini Taila'. Uniyal (1993 a) found that 'Sthal Madhuk' derived from M indica.

Chemical contents of the plant and their pharmacological action

The oil of Madhuca sp. contains oleic acid, palmitic acid, linoleic acid and myristic acid, seeds contain morwin and flowers have invert sugars and cane sugar (1). Triterpenoids are identified from seed kernals (2). nut shells and fruits (3). and in trunk barks (4). of M. latifolia. Flavonoids are isolated from fresh leaves (5). saponins from defatted seeds (6). and leaves (7). and sterols from seed oil (8). of M. latifolia. Bhatnager et al. (1972) (9). identified triterpene esters and oleanolic acid and palmitate from leaves and Kitagawa et al. (1978) identified a 'Mi saponin C' from seed kernels of M. longifolia. Chemical and biological aspects of polysaccharides from flowers of M indica are reported by Rao (1992)(10).

Daniel et al. (1978) (11) quantified the tannins (4.86%) in leaves. Gopalan et al. (1984) (12) estimated the calcium, phosphorus, vitamin C, iron and carotene in the flower of M. longifolia as 45 mg, 22 mg, 101 mg, 40 mg and 307 µg/l00 gm respectively. The seed cake of M. latifolia contains marwin (Murthy et al., 1991) (13). Atal et al. (1978) (14) reported that the stem bark of M. indica is devoid of tannins.

Atal et al. (1978) found that the extract of stem bark of M. longifolia have anti-insecticidal property against housefly. Oil of Madhuca sp. has anti-insecticidal activity against Callosohruchus cinensis (15,16) and C. macultatus (17). Stem bark extract of M. indica is inactive against Ranikhet disease virus and vaccinia virus. (18)

Stem bark extract of M indica is inactive against Bacillus suhtilis, Staphylococcus aureus, Salmonella typhi, Escherichia coli and Agrohacterium tumefaciens. It has no antifungal properties against Candida albicans, Cryptococcus neoformans, Trichophyton mentagrophytes, Microsporun canis and Aspergillus niger (18). The methanolic extracts of flowers, leaves, stem and stem bark of M. longifolia have been reported to possess antibacterial activity against Bacillus anthracis, B. pumilus, B. suhtilis, Salmonella paratyphi, Vihrio cholerae, Xanthomonas campestris and X malvacearum (19). Pasmer and Datta (1988) reported that the oil of M. latifolia has synergistic action with malathion when malathion and oil were tested at 1:1 and 1:5 levels. 50% alcoholic extract of stem bark of M indica reveal hypotensive activity and devoid of diuretic and anticancer property and LD 50- was 1000 mglkg i.p. in albino mice. (18). Seed saponins of M. longifolia are reported to have spermicidal activity at 2.0% concentration (20) and anti-inflammatory property (21). However, Banerji et al. (1979) reported that seed saponin of M. latifolia has spermicidal activity at 0.03% concentration. Seed saponion has no effect on cardiovascular activity and haemolytic activity (22) but have cholinergic activity (23).

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13. BERIBERIS VULGARIS Linn.

Syn. B. dumetorum

Common name: Kattuvalli (Barberry)

Parts used: Root bark and stem bark and their chemical constituents

Berberis vulgaris L. (from berberidacea family) is a shrub with 1 to 3 meters in height that grows in many area of world, including Iran (especially khorasan). Berberis vulgaris contains berberine, oxyacanthine and other alkaloids such as berbamine, colum-bamine, malic acid, palmatine, jatrorrhizine and berberubin (1). Fruit, leave and stem of this plant have been used for medical purposes including: hepatoprotection (2,3). cardiotonic (4). and anti-microbial activity (5, 6).

Recent studies demonstrated several cardio-vascular effects of berberine and its derivatives such as positive inotropic on isolated guinea pig atria (4). negative choronotropic activity (7). antiarrythmic activity (8). heart failure improvement in rat (9). and human (10). anti-hypertensive (11). vasodilator (12). neuroprotective (13). lowering resistance of peripheral vessels (14). and lowering cholesterol (15,16).

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Effects of Hydro-Ethanolic Extract of Berberis Vulgaris Fruit on Rabbit Isolated Heart

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Several therapeutic effects including antimicrobial, antidiarrhea, hepatoprotection and cardiotonic for Berberis vulgaris have been described. In the present study, the effects of hydro-ethanolic extract of Berberis vulgaris on the rate and contractility of isolated heart were examined. The heart mounted on a modified Langendorff apparatus and circulation was perfused through aorta. Heart rate and contractility were determined in the presence of four concentrations of hydro-ethanolic extract (0.5, 1.0, 2.0 and 5.0 mg/100ml) and diltiazem, a calcium channel blocker (0.1, 1,10 and 100 μM) in comparison with baseline values in two different groups of experiments as follows: 1) Perfused heart with normal Krebs solution

(group1 experiments, n=10). 2) Perfused heart with calcium free Krebs solution (group 2 experiments, n=9). In group 1 only 3 highest concentrations of diltiazem showed significant reduction in heart rate ($p<0.05$ to $P<0.001$). However, 3 highest concentrations of diltiazem showed significant decrease and the last 2 concentrations of hydro-ethanolic extract increased heart contractility significantly ($p<0.01$ to $P<0.001$). In group 2 only the last concentration of diltiazem showed significant reduction in heart rate and contractility ($p<0.05$). The relationship between concentrations of hydro-ethanolic extract and heart rate in both group were negative ($p<0.01$ to $p<0.001$). However, there was positive correlation between concentrations of hydro-ethanolic extract and heart contractility. These results showed that of hydro-ethanolic extract of Berberis vulgaris has strong effect on heart contractility. The results of the present study may also indicate an activatoion of the calcium channel of isolated heart by the extract.

14. CAPSICUM ANNUUM L.

Common names: Chilli, lalmirch(Hindi0, red pepper, chili pepper, lankamirch, muragay, mira pakaya.Vattal mulaku(Tamil and Malayalam)

Parts used: Fruit

Chemical constituents: Capsaicin, solanidine, solanine, solasdine, scopoletin, chlorogenic acid, alanine, amyrin, caffeic acid, camphor, carvone, cinnamic, citric acid, linalool, linoleic acid, oleic, piperine, vitamin B1, B3, C, E, oleoresin, hexanal, 2-isobutyl-3-methoxypyrazine, 2,3-butanedione, 3-carene, trans-2-hexenal, linalool, trans-p-ferulylalcohol-4-O-(6-(2-methyl-3-hydroxypropionyl) glucopyranoside and luteolin-7-O-(2-apiofuranosyl-4-glucopyranosyl-6-malonyl)-glucopyranoside, trans-p-feruloyl-β-D-glucopyranoside, trans-p-sinapoyl-β- D-glucopyranoside, quercetin 3-O-α-L-rhamnopyranoside-7-O-β-D-glucopyranoside, luteolin 6-C-β-D-glucopyranoside-8-C-α-L-arabinopyranoside, apigenin 6-C-β-D-glucopyranoside-8-C-α-L-arabinopyranoside and luteolin 7-O-[2-(β-D-apiofuranosyl)-β -D-glucopyranoside], prenigroxanthin or all-E,3R,3′S,6′S)-β,γ -carotene-3,3′,6′-triol, capsicosides A-D, 6' ',7' '-dihydro-5',5' "-dicapsaicin, capsicosides E-G, 26-O-β-D-glucopyranosyl-22-O-methyl-5alpha-furost-25(27)-en-2α,3β,22xi,26-tetraol-3-O-β-D-glucopyranosyl(1→3)-β-D-glucopyranosyl(1→2)-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl(1→4)-β-D-galactopyranoside (1), 26-O-β-D-glucopyranosyl-(25R)-5α-furost-20(22)-en-2α,3β,26-triol-3-O-β-D-glucopyranosyl (1→3)-β-D-glucopyranosyl(1→2)-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl(1→4)-β-D-galactopyranoside (2), and 26-O-β-D-gluco-pyranosyl-(25R)-5α-furosta-3β,22xi,26-triol-3-O-β-D-glucopyranosyl(1→3)-β-D-glucopyranosyl(1→2)-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl(1→4)-β-D-, Folate, 5-methyltetrahydrofolate, 5-formyltetrahydrolfolate, 10-formylfolate. Capsianosides (1-4) Capsianosides XIII, XV, IX, XVI, X and VIII. Latoxanthin was isolated as a minor carotenoid from the ripe fruits of yellow tomato shaped paprika (Capsicum annuum var. lycopersiciforme flavum) and identified as (all-E,3S,5R,6R,3′S,5′R,6′S)-5′,6′-epoxy-5,6,5′,6′-tetrahydro-β,β-carotene-3,5,6,3′-tetrol .

Pharmacological action studied

Antibacterial

C. annuumextract inhibited Salmonella typhimurium and Pseudomonas aeruginosa growth, IC50 1.5 ml/100g of meat and 0.3 ml/100g of meat respectively. At 3ml/100g of meat, the extract showed a bactericidal effect on Pseudomonas aeruginosa. Lowering of cecal Bacteroidaceae, a predominant bacterial group (from 9.4 to 9.0 log CFU/g), Bifidobacteria (from 8.7 to 7.6 log CFU/g) and Staphylococci was observed in mice fed with a diet containing 2% red pepper (1).

Antifungal

Peptides isolated from chilli pepper seeds inhibited the growth of yeasts Saccharomyces cerevisiae, Candida albicans, Candida parapsilosis, Candida tropicalis, Pichia membranifaciens, Kluyveromyces marxiannus and Candida guilliermondii (2). F1 fraction exhibited strong fungicidal activity against Candida albicans, Saccharomyces cerevisiae and Schizosaccharomyces pombe and also promoted several morphological changes to C. albicans. F1 fraction also reduced the glucose stimulated acidification of the

medium mediated by H(+)-ATPase of S. cerevisiae cells in a dose-dependent manner and caused the permeabilization of yeast plasma membrane to the dye SYTOX Green, as verified by confocal laser microscopy (3).

Anti-neoplastic

Capsaicin topically applied onto dorsal skin of female ICR mice strongly attenuated activation of NFκB and AP-1 induced by the typical tumour promoter, 12-O-tetra-decanoyl-phorbol-13-acetate (4). Capsanthin, capsanthin 3'-ester, capsanthin diester, capsorubin, capsorubin diester, capsanthin 3,6-epoxide, cucurbitaxanthin A-3'ester and β-carotene isolated from the fruits of C. annuum demonstrated potent in vitro anti-tumour-promoting activity with inhibitory effects on Epstein–Barr virus early antigen (EBV-EA) activation induced by the tumour promoter 12-O-tetra-decanoyl-phorbol-13-acetate (TPA). Capsanthin diester and capsorbin diester showed strong inhibitory effects. Capsanthin, capsanthin 3′-ester and capsanthin 3,3′-diester and major carotenoids in C. annuum demonstrated potent anti-tumour-promoting activity in an in vivo mouse skin two-stage carcinogenesis assay using 7, 12-dimethylbenz[a]anthracene as an initiator and TPA as a promoter

Antioxidant

6",7"-dihydro-5',5'"-dicapsaicin showed antioxidant activity comparable to that of capsaicin and was about 25 times more potent than α-tocopherol when compared on the ADP/Fe2+ induced liposomal lipid peroxidation (IC50 of 10 μM for 6' ',7' '-dihydro-5',5' "-dicapsaicin compared to IC50 of 250 μM for α-tocopherol) (5). Capsorubin and related compounds capsanthin, capsanthin 3,6-epoxide and cycloviolaxanthin isolated from C. annuum inhibited the oxidation of methyl linoleate in solution initiated by 2,2'-azobis(2,4-di-Me vareronitrile) (AMVN) with the antioxidative activities decreasing in the order of capsorubin, capsanthin 3,6-epoxide, capsanthin, cycloviolaxanthin to β-carotene .

Immunomodulatory

Capsicum extract and capsaicin modulate T cell-immune responses, and their immunomodulatory effects on murine PP cells are partly due to both TRPV1-dependent and -independent pathway (6).

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15. CINNAMOMUM ZEYLANICUM

Common name: Cinnamon, Canela

Habitat: This is a small semi-tropical tree, 20 to 30 feet high, with thick ovate to lanceolate leaves 4 to 7 inches long. It is hardy in the Gulf States of the U.S. Most of the cinnamon of commerce comes from Ceylon.

Parts used: It is the ground bark of the tree. Cinnamon is widely used in cookery and confections. The flavor is due to a volatile oil contained in the bark.

Antimicrobial activity of cinnamon (Cinnamomum zeylanicum) essential oil and its main components against Paenibacillus larvae from Argentine

Liesel Brenda gende, Ignazio floris, Rosalia fritz, Martin Javier Eguaras

Bulletin of Insectology (61 (1): 1-4, 2008) and chemical constituents

The physicochemical properties, composition and antimicrobial activity of cinnamon essential oil (Cinnamomum zeylanicum) were studied. The bioactivity of this essential oil against Paenibacillus larvae was analyzed by means of a combination of in vitro techniques, such as the tube dilution method and bioautography, a method employed to localize antibacterial activity on a chromatogram. Cinnamaldehyde and eugenol proved to have antibacterial effects against P. larvae. Minimal inhibitory concentration (MIC) and minimal bactericide concentration (MBC) for C. zeylanicum essential oil were between 25-100 μg/ml and 125-250 μg/ml, respectively, for all strains. Essential oil and, especially, two of its main components presented inhibitory capacity against strains of P. larvae.The results obtained in this work suggest that cinnamon (C. zeylanicum) essential oil and of its main components, cinnamaldehyde and eugenol, presented inhibitory activity against three strains of P. larvae of different geographical origin

16. COFFEA ARABICA

English: Coffee

Sanskrit: Mlech-phala

Tamil: Kapi-kottai.

Family: Rubiaceae

Coffea arabica and several other species of the plant are luxuriantly cultivated in Southern India, Madras, Mysore, Coorg, Travancore and Cochin.

Parts used: Coffee beans or the dried seeds of coffee.

Constituents: Alkaloids of Coffea arabica are caffeine, adenine, xanthine, hypoxanthine, guanosine and proteids. Dried seeds of coffee beans yield the crystalline principle .Caffeine. which is identical with Theine contained in tea. Caffeine is present in the coffee bean in both the free & combined states. The caffeine content of a cup of coffee (150ml) is about 100mg. Caffeine is medically known as Trimethyl xanthine, and the chemical formula is $C_8H_{10}N_4O_2$. When isolated in pure form, caffeine is a white crystalline powder that tastes very bitter. The chief source of pure caffeine is the process of decaffeinating coffee and tea.

Uses of Coffee as per the Traditional Indian Medicine*:*

- Coffee is a palliative in spasmodic asthma, in whooping cough, delirium tremors, and hysterical affections and in the palpitation of the heart; it is highly recommended in cholera infantum; successful in chronic diarrhoea.
- Coffee and caffeine have been used as diuretic in dropsy.
- The alkaloid caffeine and its salts, e.g., caffeine, citras, caffeine soda benzoas, etc., are largely employed in medicine.
- It is said that in early stages of typhoid fever, coffee is almost a specific.

- Roasted coffee has disinfectant and deodorant properties.
- A strong infusion of Black coffee is useful as an antisoporific in cases of poisoning such as by opium, alcohol and other stupefying or narcotic poisons.
- Given in teaspoonful doses frequently at short intervals to patients after surgical operations it checks vomiting.
- It is a good vehicle for the administration of quinine and sulphide of magnesia as it conceals the bitter and nauseous tastes of those medicines.
- A strong cup of coffee is considered a good protection from the effects of malaria.
- In their raw state coffee berries are prescribed for hemicranias and intermittent fevers.

Mechanism of action

Central nervous system: Stimulant Caffeine stimulates all levels of the CNS, in larger doses, caffeine stimulates medullary, vagal, vasomotor, and respiratory centers, promoting bradycardia, vasoconstriction, and increased respiratory rate.

Analgesia adjunct: Caffeine constricts cerebral vasculature with an accompanying decrease in cerebral blood flow and in the oxygen tension of the brain. In some patients, caffeine may reduce headache pain. A combined decoction of ginger, black pepper and coffea cures fever.

Respiratory stimulant adjunct: Although the exact mechanism of action has not been completely established, caffeine, as other methylxanthines, is believed to act primarily through stimulation of the medullary respiratory center.

Cardiac Caffeine: produces a positive inotropic effect on the myocardium and a positive chronotropic effect on the sinoatrial node, causing transient increases in heart rate, force of contraction, and cardiac output.

Vascular Caffeine: Causes constriction of cerebral vasculature with an accompanying decrease in cerebral blood flow and in the oxygen tension in the brain.

Skeletal muscles: Caffeine stimulates voluntary skeletal muscle possibly by inducing the release of acetylcholine, increasing the force of contraction and decreasing muscle fatigue. This stimulation of diaphragmatic muscles decreases the work of breathing.

Gastrointestinal secretions: Caffeine causes secretion of both pepsin and gastric acid from parietal cells.

Renal Caffeine: Increases renal blood flow and glomerular filtration rate and decreases proximal tubular reabsorption of sodium and water, resulting in a mild diuresis. Caffeine also inhibits uterine contractions, increases plasma and urinary catecholamine concentrations, and transiently increases plasma glucose by stimulating glycogenolysis and lipolysis. In neonates, caffeine causes a 25% increase in oxygen consumption, blood vessel dilatation, cerebral vessel vasoconstriction, and smooth muscle relaxation

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17. CORIANDRUM SATIVUM L.

Common name: Coriander (Englesh), Kothamalli (Tamil), Malli (Malayalam), Dhania (Hindi)

Parts used: seeds and leaves

Habitat: Coriander, *Coriandrum sativum* L., is an annual herb native to the eastern Mediterranean region and southern Europe. Valued for the dry ripe fruits, called coriander seeds, the herb is produced in Morocco, Romania, Mexico, Argentina, the People's Republic of China, Bangladesh, Bulgaria, Canada, Egypt, India, Indonesia, Nigeria, Poland, Syria, the United States, the USSR, and Yugoslavia.

Constituents: The essential oil content are d-linalool, camphor, d--pinene, camphene, -pinene, sabinene, myrcene, -terpinene, -terpinene, limonene, and other constituents

The fruit has been used as a drug for indigestion, against worms, and as a component of embrocations for rheumatism and pains in the joints. The fruits of coriander are: alterative, antibilious, antispasmodic, aphrodisiac, appetizer, aromatic, carminative, diaphoretic, diuretic, refrigerant, stimulant, stomachic, tonic (1).

Fresh leaves are pungent and aromatic. The essential oil of coriander stimulates the secretion of gastric juices and is a carminative and spasmolytic; in vitro it has antibacterial and antifungal effects (2,3). It contains an essential oil (up to 1%) constituted of (3S)-linalool (main, 60—70%), other monoterpenoids (citronellol, geraniol, myrcene) gamma -terpinene, limonene, D-phellandrene and E- phellandrene, p-cymene, and E-pinene, borneol, and camphor), and fatty acids (oleic, linolenic, and palmitic acids etc.) Ishikawa et al investigated water-soluble constituents of spices, and showed the relationship between the essential oil and the water-soluble constituents, viz two separate two monoterpenoid triols, seven monoterpenoid glycosides, three norcarotenoid glucosides, an aromatic compound, seven aromatic compound glycosides, two alkyl glucosides, eight glucides, uracil, and two nucleosides. Linalool (59.6-71.6%) has been reported as the mainconstituent of the essential oil of coriander fruits (4,5**)**.

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Study the Possible Protective and Therapeutic Influence of Coriander (Coriandrum sativum L.) Against Neurodegenerative Disorders and Alzheimer's disease Induced by Aluminum Chloride in Cerebral Cortex of Male Albino Rats

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Several studies reported many neurodegenerative disorders and Alzheimer' disease induced by aluminum chloride on cerebral cortex of male rats. Coriander (Coriandrum sativum) is a plant among others which improve blood circulation to the head, impart mental concentration and memory capabilities. Coriander, both its leaves and its seeds are grown as spice group all over the world. The present investigation aims to clarify the role of coriander seed aqueous extract as a protective and therapeutic agent against neurodegenerative disorders and Alzheimer's disease induced by $AlCl_3$ on the pyramidal cells in cerebral cortex of male albino rats. 24 Adult male albino rats were divided into four groups 6 for each, control,

(300mg/kg p.o) $AlCl_3$ treated group for a month, (300mg/kg p.o.) $AlCl_3$ plus (0.5gm/kg p. o) aqueous seed coriander extract treated group for a month and (0.5gm/kg p.o.) aqueous seed coriander extract treated group after stopping aluminum chloride treatment each for a month. Specimens from cerebral cortex were processed for haematoxylin and eosin, toluidine blue and Nauta stains. Aluminum chloride treatment showed dilatation of blood capillaries and presence of many shrunken pyramidal cells, the cells are pale and chromatolytic, the fibers appear detached and irregular in thickness. Aluminum chloride and coriander treated group restore the pyramidal cells of the cerebral cortex to normal. The treatment with coriander for a month after stopping $AlCl_3$ treatment restores the pyramidal cells to nearly normal. In conclusion coriander seed aqueous extract show protection and an improvement in therapeutic action on pyramidal cells in cerebral cortex against neurodegenerative disorders and Alzheimer' disease induced by aluminum chloride treatment.

18. CROCUS SATIVUS L

Common name: Saffron, Kesar or Zafran (Hindi), Kunguma poovu (malayalam)

Habitat: Saffron, *Crocus sativus* L. is a perennial herb known, only in cultivation. The plant has been prized since antiquity for the yellow-colored dyestuff that comes from the flower stigmas. Also known as saffron crocus, the species is principally grown in Spain, but is also cultivated in Greece, Turkey, India, France, Italy, and the People's Republic of China.

Parts used: flowers

Constituents: Saffron contains a volatile oil, picrococin, crocin, a fixed oil, and wax. The volatile oil consists of safranal, oxysafranal, pinene, 1,8-cineole isophorone, napthalene and other compounds. Extracted saffron is a red-orange color, and has an aromatic odor and a bitter taste. Principal coloring pigments of saffron include crocin, crocetin, carotene, lycopene, zeaxanthin, and picrocrocin .

As a medicinal plant, saffron has traditionally been considered an anodyne, antispasmodic, aphrodisiac, diaphoretic, emmenagogue, expectorant, and sedative. The plant has been used as a folk remedy against scarlet fever, smallpox, colds, insomnia, asthma, tumors, and cancer. Saffron is reported to contain a poison of the central nervous system and kidneys that can prove fatal (Honeychurch, 1980).

Crocus sativus L. commonly known as saffron, is a perennial stemless herb of the Iridaceae family and widely cultivated in Iran and other countries such as India and Greece (1). Commercial saffron comprises the dried redstigma with a small portion of the yellowish style attached. Compounds considered pharmacologically active and important are volatile agents (e.g. safranal), bitter principles (e.g. picrocrocin) and dye materials (e.g. crocetin and its glycoside, crocin) (1). In modern pharmacological studies, saffron, or its active constituents, has demonstrated anticonvulsant (2), antidepressant (3), anti-inflammatory (4) and antitumour activities (5,6). Radical scavenger effects as well as learning and memory improving properties (7,8) and increase in the diffusivity of oxygen in different tissues were also reported (1). Saffron extract is also chemopreventive and showed protective effects on genotoxins-induced oxidative stress in Swiss albino mice (9-11). Recently, Assimopoulou et al. (12) showed that the saffron extract, crocin and safranal exhibited significant radical scavenging activity and thus antioxidant activity. There was also a constant decrease in lipoprotein oxidation susceptibility in healthy individuals after administration of 50 mg of saffron twice a day (13). Saffron and its constituents have been shown to decrease I/R injury in kidney (14) or brain tissues (15). Saffron is known to contain various chemical constituents including crocin-1, picrocrocin, startry, vitamins, B1 and B2, fixed oils, carotenoids, colichicine, quercitin, proteins, wax and mucilage (16)

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Crocus Sativus L. (Saffron) Extract and its Active Constituents (Crocin and Safranal) on Ischemia-Reperfusion in Rat Skeletal Muscle

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Saffron and its constituents have been shown to decrease ischemia-reperfusion (I/R) injury in kidney or brain tissues. **In this study, the effects of saffron ethanolic extract and its constituents, crocin and safranal, were evaluated in skeletal muscle during I/R injury.** Hind limb ischemia was induced using clamping the common femoral artery and vein. After 2 h ischemia, the clamp of the femoral vessels of animals was taken off and the animal underwent 1h reperfusion. Muscle injuries were evaluated by recording of the electromyographic (EMG) potentials and performing some biochemical analysis including thiobarbituric acid reactive substances (TBARS), total sulfhydryl (SH) groups and antioxidant capacity of muscle (using FRAP assay). The ethanolic extract of saffron (5, 20 and 80 mgkg_1), crocin (50, 200 and 400 mg kg_1), safranal (0.1, 0.25 and 0.5 ml kg_1) and normal saline (10 ml kg_1) were administered intraperitoneally 1 h prior reperfusion. The average peak-to-peak amplitude during I/R was significantly increased in extract, crocin and safranal groups in comparison with control-ischemic group. Following saffron, crocin and safranal administration, the total SH contents and antioxidant capacity were elevated in muscle flap. TheMDAlevel was declined significantly in test groups. It is concluded that saffron extract and its constituents show a protective effect against lower limb I/R in rat.

19. CUMINUM CYMINUM L.

Syn: Cuminum odorum Salisb

Family: Apiaceae (Umbelliferae),

Common name: Cumin (Englesh), Jeera (Hindi and Bengal) Jeeragam (Malayalam)

Habitat: Cumin, is a small annual herb native to the Mediterranean region. Primary cultivation of cumin is in Europe, Asia, the Middle East, and North Africa with India and Iran as the largest cumin exporters.

Parts used: The valued portion of the plant is the dried fruit called cumin seed, which is esteemed as a condiment.

Constituents: d,1-pinene, d--pinene, para-cymene, -pinene, dipentene, and cuminyl alcohol . Synthetic cuminaldehyde is an adulterant to cumin oil and is very difficult to detect chemically.

CHEMICAL AND BIOLOGICAL CHARACTERSTICS OF CUMMINUM CYMINUM

Agarwal V. et al. / Journal of Natura Conscientia 2010, 1(1), 148-156

Cuminum cyminum, Umbelliferae a small slender annual herb about 60 cm high, with much branched angular or striated stem, bearing 2 or 3 Partite linear leaves , flowers are white or rose colored borne in compounds, fruits are grayish about . inch long (1) The crop can be grown on plains and at heights of over 3,335mt. It can produce two crops per year, one halfway through the month of April and the other at the end of October (2) The flowers are hermaphrodite (have both male and female organs) and are pollinated by Insects. It requires dry or moist soil. The plant is grown extensively in South eastern, Europe and North Africa and in India mostly found in U.P. and Punjab (3,4).

Chemistry of Cuminum cyminum

The seeds of Cuminum cyminum were analyzed and it was reported that, analytical contents of seeds are (in percentage): moisture 11.9; protein 18.7; ether extractive 15.0; carbohydrates 36.6; fiber 12.0; mineral matter 5.8; calcium 1.08; phosphorus 0.49%; iron 31.0 mg/100 g; carotene calculated as vitamin A 870 1.U./100 g; and vitamin C 3.0 mg/100 g . The seeds on distillation yield a volatile oil (2.0-4.0%) having an unpleasant characteristic odor, spicy and somewhat bitter taste. The oil is colorless or yellow in appearance. The chief constituent of the volatile oil is aldehyde, cuminaldehyde which forms nearly 20-40% of the oil. Besides the aldehyde, oil contains p-cymene, pinene, dipentene,cumene,cuminic alcohol, beta.-phellandrene and alpha.- terpineol (3). The residue left after thevolatile oil extraction contains 17.2% protein and 30.0% fat. It can be used as cattle feed Besides volatile oil seeds contains 10% fixed oil, which is greenish brown in color with a strong aromatic flavor. Other chemical constituents reported are apigenin-7- glucoside, apigenin-7-diglucoside, apigenin-7,4'-diglucoside, apigenin-7- digalacturonide, apigenin-7- galacturonylglucoside, apigenin-7- digalacturonide-4'-glucoside, apigenin-6,8-di-C-glucoside, luteolin-glucoside, luteolin-7-diglucoside, luteolin-7,3'- diglucoside, luteolin-7,4'-diglucoside and luteolin-7-galacturonide-4'- glucoside and chrysoeriol glycoside. In addition, the seeds yield about 22% fats, numerous free amino acids. The cuminaldehyde content varies considerably, depending on the source of the oil (fresh vs. ground seeds). Fine grinding of the seed can result in the loss of up to 50% of the volatile oil, with the greatest loss occurring within 1 hour of milling. Another major component of the oil is monoterpene hydrocarbons. Sesquiterpenes constitute minor Constituents (4,5). The seeds contain cuminol, cymine, hellandren, carvone, cuminique alcohol (6). The chief components of the characteristic aroma of unheated whole seeds are menthen- 7al and cuminaldehyde in combination with other related aldehydes. Cumin contains safrole, a natural mutagenic compound, which gets degraded on cooking (7).

Traditional and Medicinal uses

Cumin seed was once widely used as food flavouring in Europe; the Romans ground it into a powder and used it like pepper. Methanolic extract of Cuminum cyminum can be a potential candidate to be explored for the treatment of menopausal disorders, especially cardiovascular disorders in postmenopausal women (8). The seed is harvested when fully ripe and is then dried and stored in airtight jars the essential oil from Cuminum cyminum possess anti-carcinogenic activity (9). An essential oil from the seed is used as food

flavouring. Cumin is an aromatic, astringent herb that benefits the digestive system and acts as a stimulant to the sexual organ. It is still widely used in India, however where it is said to promote the assimilation of other herbs and to improve liver function. The seed is antispasmodic, carminative, stimulant and stomachic. In India it is also used in the treatment of insomnia, colds and fevers and to improve milk production in nursing mothers. The essential oil obtained from the seed possesess antibacterial activity. Cumin essential oil demonstrated activity (reported to be comparable with standard antibiotics) against common human pathogens in *in vitro* experiments and against gram-negative and grampositive plant pathogens. Cuminum cyminum is a common dietary adjunct that contributes to the taste and flavour of foods. Besides this, it was also reported to exert several beneficial physiological effects including the antidiabetic influence. Cuminum cyminum exhibits hyperlipidemic effect on the plasma and tissue lipids in alloxan diabetic rats.The ethanolic extracts of Cuminum cyminum L. expressed antibacterial activity at MIC90 values of 0.075 mg/ml, showed a significant in vitro effect against H. pylori that could be considered a valuable support in the treatment of the infection and may contribute to the development of new and safe agents for inclusion in anti- H.Pylori regimens. The inhibitory activity of Cuminum cyminum seed-isolated component was evaluated against lens aldose reductase and alpha-glucosidase, isolated from Sprague-Dawley male rats. The antioxidant activity of the aqueous extract of umbelliferous fruit, cumin (Cuminum cyminum) was investigated in comparison with the known antioxidant ascorbic acid in *in-vitro* studies. It revealed that strong antioxidant activity of the extract was superior to known antioxidant ascorbic acid and indicates that its intake may be beneficial as food additives. Cumin seeds (Cuminum cyminum Linn) significantly decreased the incidence of neoplasia and 3'-MeDAB-induced hepatomas, may prove to be valuable anti-carcinogenic agents. Cumin can decrease the lipid levels in alcohol and thermally oxidized oil induced hepatotoxicity. Its prime constituentsapigenin inhibits the production of nitric oxide and prostaglandin E, apigenin also has an inhibitory effect on the expression of TNF α and IL-1Hgenes in macrophages thus playing a protective role against inflammation. It also prevent hepatocellular carcinogenesis. Cuminum cyminum did not show any cholesterol lowering effect when added to normal and hypercholesterolemia inducing diet on serum and liver cholesterol levels in rat. Estrogenic activity of Cuminum cyminum in rats was also reported. Studies were carried out on galactgogue action of Cuminum cyminum. It showed a potent relaxant effect on guinea pig tracheal chains which may be due to a stimulatory effect of the plant on β-adrenoceptors and/or an inhibitory effect on histamine H1 receptors 46. Oil of cuminum cyminum showed a potent anticonvulsant activity. Therapeutic role of Cuminum cyminum on ethanol and thermally oxidized sunflower oil induced toxicity was studied has been used as a toothache remedy in folk medicine of Iran. The potential anti-nociceptive and antiinflammatory activities of the fruit essential oil of Cuminum cyminum has been evaluated in chemical (formalin test) and thermal (tail-flick test) models of nociception and formalin model of acute inflammation in rats and mice. Cumin oil and cuminaldehyde have been reported to exhibit strong larvicidal activity. Cumin oil inhibited the growth of Lactobacillus plantarum.

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20. CURCUMA LONGA Linn.

Common name: Turmeric (Englesh), Haldi (Hindi), Manjal (Tamil and Malayalam)

Habitat: The plant is a large-leaved herb, closely related to ginger. It is cultivated in tropical countries for the thick, rounded, underground stems or rhizomes, which constitute the spice, turmeric.

Parts used: Rhizome (root)

Constituents: Turmeric contains an oil, which consists in part of curcumin, which on oxidation is changed into vanillin, the active principle in vanilla. The rootstocks of turmeric, both fresh and dried, are also used as flavoring in curries and other cookery.

Curcuma longa, a perennial herb and member of the Zingiberaceae (ginger) family, grows to a height of three to five feet and is cultivated extensively in Asia, India, China, and other countries with a tropical climate. It has oblong, pointed leaves and funnel-shaped yellow flowers (1). The rhizome, the portion of the plant used medicinally, is usually boiled, cleaned, dried and ground yielding a yellow powder. Dried Curcuma longa is the source of the spice turmeric, the ingredient that gives curry powder its characteristic yellow color. Turmeric is used extensively in foods for both its flavor and color, as well as having a long tradition of use in the Chinese and Ayurvedic systems of medicine, particularly as an anti-inflammatory and for the treatment of insect bites, flatulence, jaundice, menstrual difficulties, hematuria, hemorrhage, and colic. Turmeric can also be applied topically in poultices to relieve pain and inflammation (2). Current research has focused on turmeric's antioxidant, hepatoprotective, anti-inflammatory, anticarcinogenic, and antimicrobial properties, in addition to its use in cardiovascular disease and gastrointestinal disorders.

Active Constituents of turmeric and many spices contain very good nutraceuticals

The active constituents of turmeric are the flavonoid curcumin (diferuloylmethane), borneol and various volatile oils, including turmerone, atlantone, and zingiberone. Other constituents include sugars, proteins, and resins. The best-researched active constituent is curcumin, which comprises 0.3-5.4 percent of raw turmeric. Curcumin related compounds are curcumin 1, cyclocurcumin, Demethoxy curcumin and Bis demethoxy curcumin. Nutraceuticals boost up body's immunity against disease causing germs and virus.

Pharmacokinetics

Pharmacokinetic studies in animals have demonstrated that 40-85 percent of an oral dose of curcumin passes through the gastrointestinal tract unchanged, with most of the absorbed flavonoid being metabolized in the intestinal mucosa and liver (3,4). Due to its low rate of absorption, curcumin is often formulated with bromelain for increased absorption and enhanced anti-inflammatory effect.

Mechanisms of Action

Antioxidant Effects

Water- and fat-soluble extracts of turmeric and its curcumin component exhibit strong antioxidant activity, comparable to vitamins C and E.5 A study of ischemia in the feline heart demonstrated that curcumin pretreatment decreased ischemia-induced changes in the heart. (6) An *in vitro* study measuring the effect of curcumin on endothelial heme oxygenase-1, an inducible stress protein, was conducted utilizing bovine aortic endothelial cells. Incubation (18 hours) with curcumin resulted in enhanced cellular resistance to oxidative damage. (7)

Hepatoprotective Effects: Turmeric has been found to have a hepatoprotective characteristic similar to silymarin. Animal studies have demonstrated turmeric's hepatoprotective effects from a variety of hepatotoxic insults, including carbon tetrachloride (CCl4) (8,9) galactosamine,(10) acetaminophen (paracetamol), (11) and Aspergillus aflatoxin.(12) Turmeric's hepatoprotective effect is mainly a result of its antioxidant properties, as well as its ability to decrease the formation of proinflammatory cytokines. In rats with CCl_4-induced acute and subacute liver injury, curcumin administration significantly decreased liver injury in test animals compared to controls. (9) Turmeric extract inhibited fungal aflatoxin production by 90 percent when given to ducklings infected with Aspergillus parasiticus. Turmeric and curcumin also reversed biliary hyperplasia, fatty changes, and necrosis induced by aflatoxin production.(12) Sodium curcuminate, a salt of curcumin, also exerts choleretic effects by increasing biliary excretion of bile salts, cholesterol, and bilirubin, as well as increasing bile solubility, therefore possibly preventing and treating cholelithiasis.(13)

Anti-inflammatory Effects

The volatile oils and curcumin of Curcuma longa exhibit potent anti-inflammatory effects. (14-16) Oral administration of curcumin in instances of acute inflammation was found to be as effective as cortisone or phenylbutazone, and one-half as effective in cases of chronic inflammation. (16) In rats with Freund's adjuvant-induced arthritis, oral administration of Curcuma longa significantly reduced inflammatory swelling compared to controls. (15) In monkeys, curcumin inhibited neutrophil aggregation associated with inflammation. (17) C. longa's anti-inflammatory properties may be attributed to its ability to inhibit both biosynthesis of inflammatory prostaglandins from arachidonic acid, and neutrophil function during inflammatory states. Curcumin may also be applied topically to counteract inflammation and irritation associated with inflammatory skin conditions and allergies, although care must be used to prevent staining of clothing from the yellow pigment. (16)

Anticarcinogenic Effects

Animal studies involving rats and mice, as well as in vitro studies utilizing human cell lines, have demonstrated curcumin's ability to inhibit carcinogenesis at three stages: tumor promotion, (18) angiogenesis, (19) and tumor growth. (20) In two studies of colon and prostate cancer, curcumin inhibited cell proliferation and tumor growth.(21,22) Turmeric and curcumin are also capable of suppressing the activity of several common mutagens and carcinogens in a variety of cell types in both *in vitro* and *in vivo* studies. (23-26) The anticarcinogenic effects of turmeric and curcumin are due to direct antioxidant and free-radical scavenging effects, as well as their ability to indirectly increase glutathione levels, thereby aiding in hepatic detoxification of mutagens and carcinogens, and inhibiting nitrosamine formation.(27)

Antimicrobial Effects

Turmeric extract and the essential oil of Curcuma longa inhibit the growth of a variety of bacteria, parasites, and pathogenic fungi. A study of chicks infected with the caecal parasite Eimera maxima demonstrated that diets supplemented with 1-percent turmeric resulted in a reduction in small intestinal lesion scores and improved weight gain. (28) Another animal study, in which guinea pigs were infected with either dermatophytes, pathogenic molds, or yeast, found that topically applied turmeric oil inhibited dermatophytes and pathogenic fungi, but neither curcumin nor turmeric oil affected the yeast isolates. Improvements in lesions were observed in the dermatophyte- and fungi-infected guinea pigs, and at seven days post-turmeric application the lesions disappeared. (29) Curcumin has also been found to have moderate activity against Plasmodium falciparum and Leishmania major organisms. (30)

Cardiovascular Effects

Turmeric's protective effects on the cardiovascular system include lowering cholesterol and triglyceride levels, decreasing susceptibility of low density lipoprotein (LDL) to lipid peroxidation, (31) and inhibiting platelet aggregation. (32) These effects have been noted even with low doses of turmeric. A study of 18 atherosclerotic rabbits given low-dose (1.6-3.2 mg/kg body weight daily) turmeric extract demonstrated decreased susceptibility of LDL to lipid peroxidation, in addition to lower plasma cholesterol and triglyceride levels. The higher dose did not decrease lipid peroxidation of LDL, but cholesterol and triglyceride level decreases were noted, although to a lesser degree than with the lower dose. (31) Turmeric extract's effect on cholesterol levels may be due to decreased cholesterol uptake in

the intestines and increased conversion of cholesterol to bile acids in the liver. (13) Inhibition of platelet aggregation by C. longa constituents is thought to be via potentiation of prostacyclin synthesis and inhibition of thromboxane synthesis. (32)

Gastrointestinal Effects

Constituents of Curcuma longa exert several protective effects on the gastrointestinal tract. Sodium curcuminate inhibited intestinal spasm and p-tolymethylcarbinol, a turmeric component, increased gastrin, secretin, bicarbonate, and pancreatic enzyme secretion. (33) Turmeric has also been shown to inhibit ulcer formation caused by stress, alcohol, indomethacin, pyloric ligation, and reserpine, significantly increasing gastric wall mucus in rats subjected to these gastrointestinal insults. (34)

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NB: Additional informotions on this medicinal plant are given by Lekshmi R Nath et al in the next section of this chapter.

21. CYMBOPOGON SPECIES

Common name: Lemon grass, Theruvu pullu(Malayalam)

Habitat: Lemongrass, a perennial herb widely cultivated in the tropics and subtropics, designates two different species, East Indian, Cymbopogon flexuosus (DC.) Stapf., and West Indian, Cymbopogon citratus (DC. ex Nees) Stapf. East Indian lemongrass, also known as cochin or Malabar grass is native to India, while West Indian lemongrass is native to southern India and Ceylon. The lemongrasses are cultivated commercially in Guatemala, India, the People's Republic of China, Paraguay, England, Sri Lanka, and other parts of Indochina, Africa, Central America, and South America.

Parts used: Leaves and its oil

Constituents: The quality of lemongrass oil is generally determined by the content of citral, the aldehyde responsible for the lemon odor. Some other constituents of the essential oils are -terpineol, myrcene, citronellal, methyl heptenone, dipentene, geraniol, limonene, nerol, and farnesol

Cymbopogon olivieri (Boiss.) Bar (Andropogonae) is a plant growing in south east of Iran. The Andropogonae is the subtype of Graminae. This plant family grows under divers conditions of climate and many species of this family are consumed as aliments (1-4). A few investigation have been accomplished about the Cymbopogon species. The main constituents of this species are alkaloids, saponin

and essential oil (5). The essential oil of several species of Cymbopogon have been studied and the important components which were identified are; citral in C. pendalus and C. flenuosus (6), citronellol, citronellal and geraniol in C. nardus and C. winterianus (7) and geranial, geraniol and citronellol in C. martini (8). The essential oil of C. olivieri which grows in India has also analyzed, 3-pinene, myrcene, pulgone and piperitone were the major constituents (9), and this essential oil showed interesting anti-fungi activity. Previously by our laboratories, constituents and effects of the essential oils of aromatic plants grown in Iran against the larvae of the vectors of Malaria and Schistosoma were reported (10-12).

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CHEMICAL COMPOSITION AND CARDIOVASCULAR EFFECTS INDUCED BY THE ESSENTIAL OIL OF CYMBOPOGON CITRATUS DC. STAPF, POACEAE, IN RATS FLÁVIA V. MOREIRA, JOANA F. A. BASTOS, ARIE F. BLANK,] PÉRICLES B. ALVES, MÁRCIO R. V. SANTOS BRAZILIAN JOURNAL OF PHARMACOGNOSY1210 RECEIVED 5 OCOTBER 2009; ACCEPTED 3 MARCH 2010

Cymbopogon citratus DC. Stapf, Poaceae, is used in the folk medicine for hypertension treatment. This work investigated the chemical composition and cardiovascular effects in rats of C. citratus essential oil (EOCC). A phytochemical screening demonstrated the presence of eight constituents, being geranial the major compound (43.08%). In rats, EOCC (1, 5, 10, and 20 mg/kg, i.v.) induced transient hypotension and bradycardia that were attenuated by atropine and sodium thiopental, but not by L-NAME or indomethacin. In rings of rat superior mesenteric artery pre-contracted with phenylephrine, EOCC (1 to 3000 μg/mL) induced relaxation that was not affected after removal of the endothelium, after TEA or in rings pre-contracted with KCl (80 mM). Furthermore, EOCC (1000 μg/mL) was not able to induce additional effect on maximal relaxation of nifedipine (10 μM). In conclusions, EOCC induces hypotension, possibly by reduction in vascular resistance caused by inhibition of the Ca2+ influx, and bradycardia probably due to an activation of cardiac muscarinic receptors.

THE CHEMISTRY, PHARMACOLOGY AND USES OF ADHATODA VASICA NEES TO CURCUMA LONGA LINN LEKSHMI R NATH, SOPHIA MARGARET JOSEPH AND RUBY JOHN ANTO SCIENTIST E1 DIVISION OF CANCER RESEARCH, RAJIV GANDHI CENTRE FOR BIOTECHNOLOGY, THIRUVANANTHAPURAM -695014

In the present review we have included 7 medicinally important plants which are being used in Ayurveda for the treatment of various ailments. We have looked in to the important chemical constituents present in these plants, their pharmacology and their important uses in ayurvedic treatements. We have also included the method of isolation of some of the important components from these plants. The plants we have included in this review are *Adhatoda vasica* Nees, *Andrographis paniculata (Burm. f.)* Nees, *Azadirachta indica*, *Bacopa Monniera* Linn, *Berberis aristata D.C, Boerhaavia diffusa* Linn, *Centella asiatica* (L.) urban, *Commiphor mukul* (Hook.exstocks) Engl and *Curcuma longa* Linn.

1. ADHATODA VASICA NEES (Acanthaceae)

Hindi: Arusa

Malayalam: Atalotakam

Sanskrit: Vasaka

Synonym: Vasaka, Malabar nut

Parts used: Leaves and flowers.

Chemistry: The plant *Adhatoda vasica* contains quinazoline type of alkaloid such as vasicine, vasicinone, vasicinol and also other constituents like betain, vasakin and adhatodic acid (Evans, 2002). Thappa *et al* (1996) has isolated two new pyrroloquinazoline alkaloids, *viz.* 1, 2, 3, 9- tetrahydropyrrolo, quinazolin- 9, 1-3R –hydroxy -3 (2' dimethylaminophenyl (desmethoxyaniflorine) and 7-methoxy-3R-hydroxy-l, 2, 3, 9-tetrahydropyrrolo -[2, 1-b]-quinazolin- 9- one (7-methoxyvasicinone), together with several known compounds from the leaves of *A.vasica*. A new triterpenoid, 3α -hydroxy- D- friedoolean-5-ene, along with the known compounds, epitaraxerol and peganidine, have been isolated for the first time from the aerial parts of *A.vasica* (Atta-Ur-Rahman *et al*.,1997).

Pharmacology:

***Hepatoprotective activity*:** Studies by Pandit *et al* (2004) reported that pretreatment with the ethanolic extract of leaves of *A. vasica* (test drug AV) in both doses (100 and 200 mg/kg) significantly reduced antioxidant enzyme levels such as serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT) and serum alkaline phosphatase (ALP), dose dependently compared to pretreatment with standard drug silymarin. Their study showed that adathoda extract is hepatoprotective as an antioxidant and indicated that pretreatment with adathoda extract (100 and 200mg/kg) offered protection to the hepatocytes from damage induced by CCl4, with mild fatty changes in the hepatic parenchymal cells. It has also been reported that aqueous extract of *A. vasica* leaf has significant hepatoprotective effect at doses of 50–100 mg/kg, p.o., on liver damage induced by D-galactosamine in rats compared to standard drug Silymarin (Bhattacharyya *et al*.,2005).

Antitussive activity: Studies by Dhuley *et al.*, (1999) suggest that the intravenous injection of ethanolic extract of *Adhatoda vasica* leaf (AV) extract cause dose-dependent cough inhibition at 5 mg/kg and 20 mg/kg, the inhibition was almost complete compared to codeine as assessed by mechanical stimulation of the trachea induced in rabbits. In this test, AV extract was about 1:10 as active as codeine. AV extract given intravenously at 15.5 mg/kg cause dose-related inhibition of coughing induced by electrical stimulation of guinea pig vagus nerve compared with codeine (0.8 mg/kg). Oral administration of AV extract also dose-relatedly inhibited coughing induced by electrical stimulation of tracheal mucosa in unanaesthetized guinea pigs, AV extract was 1:4 as active as codeine.

Antioxidant activity: It has been reported that the ethanolic extract of the leaves of *A. vasica* at two different doses (50 and 100 mg/kg body wt/day) show significant increase in the activities of acid soluble sulfhydryl content, cytochrome P450, NADPH-cytochrome P450 reductase, cytochrome b_5, NADH-

cytochrome b_5 reductase, glutathione S-transferase (GST), DT-diaphorase (DTD), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and glutathione reductase (GR) in the liver at both dose levels and also showed significant decrease in malondialdehyde (MDA) formation in liver, suggesting its role in protection against prooxidant induced membrane damage (Singh *et al.,*2000). Vasicine isolated from the leaves of *Adhatoda vasica* is reported to possess significant antioxidant activity indicated by a decrease in lipid peroxidation and similarly significant increase in antioxidants superoxide dismutase, catalase, glutathione peroxidase and reduced glutathione (Srinivasaro *et al*.,2006).

Antiinflammatory activity: Anti-inflammatory activity of the methanol extract of *A. vasica* was studied by Chakraborty *et al*., (2001). They have found that the alkaloid fraction has potent activity at a dose of 50 µg/pellet equivalent to that of hydrocortisone.

Antidiabetic activity: It has been reported that the methanolic extract of *A. vasica* leaves have the highest sucrase inhibitory activity with sucrose as a substrate. Enzyme assay-guided fractionation of this extract was found to afford vasicine and vasicinol, with a high sucrase inhibitory activity (IC_{50} values 125 µM and 250 µM, respectively) suggesting the use of the extract of *A. vasica* as an antidiabetic agent (Gao *et al*., 2008).

Antibacterial activity: The crude ethanolic extract of the leaf was shown to exhibit significant antimicrobial activity against the *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Bacillus subtilis*, *Proteus vulgaris* and *Candida albicans* as determined by agar-well diffusion method. The MIC of the ethanolic extract of *A. vasica* against bacterial pathogens, such as, *S. aureus*, *S. epidermidis*, *B. subtilis* and *P. vulgaris* was found to be 75mg/ml and for *C. albicans* 100 mg/ml (Karthikeyan *et al.,* 2009). The methanolic extract of *A. adhatoda* plant was found to exhibit positive antimicrobial activity against *Pseudomonas aeruginosa, Bacillus subtillus***,** and *Staphylococcus aureus* compared to chloramphenicol (30 µg) as assessed by agar well diffusion assay (Shinwari *et al.,* 2009).

Extraction & Isolation: Powdered *A. vasica* leaves is extracted with EtOH by cold percolation. The EtOH extract is concentrated and the residue treated with dil. HC1 for separation of alkaloids. The acid layer is further extracted three times with $CHC1_3$ to remove non-alkaloidal material. The acid layer is then basified with NH_4OH and the soln extracted with $CHC1_3$. The residue obtained upon recrystallization from MeOH give vasicine (Thappa *et al*.,1996).

Uses: Fresh leaves and flowers or their decoction are used in conditions such as fever, bronchitis, asthma, haemorrhage, dyspepsia, anorexia, haemoptysis and respiratory diseases. Also used in treatement of malaria (Khare, 2004).

2. ANDROGRAPHIS PANICULATA (Burm. f.) Nees (Acanthaceae)

Hindi: Kirayat

Malayalam: Nilavembu, Kiriyattu

Sanskrit: Kālamegha

Synonym: Kalmegh. Parts used- Leaves and whole plant.

Chemistry: Andrographolide, 14-deoxy-11-oxoandrographolide, 14-deoxy-11, 12-didehydroandrographolide and neoandrographolide are compounds that have been isolated from the dichloromethane extract of *Andrographis paniculata* (Kumar *et al.,* 2004).

Pharmacology:

Anticancer activity: Andrographolide, the major diterpenoid of the *A. paniculata* extract has been reported to possess cytotoxic activity against KB (human epidermoid carcinoma) and P388 (lymphocytic leukaemia) cells (Siripong *et al.,* 1992). The methanol extract of aerial parts of *A. paniculata* and some of the isolated compounds have been found to show growth inhibitory and differentiating activity on M1 (mouse myeloid leukaemia) cells (Matsuda *et al.,* 1994). It has also been reported that andrographolide exerts direct anticancer activity on human cancer cells by cell cycle arrest at G0/G1 phase through induction of cell cycle inhibitory protein p27 and decreased expression of cyclin dependent kinase 4

(CDK4) and also indirect anticancer activity through enhanced tumor necrosis factorα production and CD marker expression, resulting in increased cytotoxic activity of lymphocytes against cancer cells. The *in vivo* anticancer activity of the compound has been further substantiated against B16F0 melanoma syngenic and HT29 xenograft models (Rajagopal *et al.,* 2003). It has been shown that methanolic (10µg/ml), petroleum ether (46 µg/ml) and dichloromethane (10µg/ml) extracts of *A. paniculata* inhibit the proliferation of HT-29 cells but, the aqueous extract did not inhibit the proliferation of HT-29 cells. Also three diterpene compounds isolated from the dichloromethane extract, i.e. andrographolide, 14-deoxyandrographolide and 14-deoxy-11,12-didehydroandrographolide has been found to enhance proliferation and interleukin-2 (IL-2) induction in human peripheral blood lymphocytes (Kumar *et al.,* 2004).

Immunomodulatory activity: The ethyl alcohol extract and purified diterpene andrographolides are reported to stimulate both antigen specific and non specific immune responses in mice (Puri *et al.,* 1993). Studies by Rajagopal *et al*. (2003) suggest the immunostimulatory activity of andrographolide as evidenced by increased proliferation of lymphocytes and production of interleukin 2 indicating that it is able to interfere with T cell proliferation *in vitro* and cytokine release in response to allogenic stimulation (Iruretagoyena *et al.,* 2005).

Antimicrobial acivity: Aqueous extract of the herb *A. paniculata*, has been reported to possess significant antibacterial and antifungal activities against *Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa* and *Candida albicans* in comparison to some known antibiotics (Streptomycin, Gentamycin, Nystatin) as assessed by antibiotic disc diffusion assay method. It was suggested that this may be due to the combined effect of the isolated arabinogalactan proteins and andrographolides (Singha *et al.,* 2003). Studies by Ghosh *et al.* (2004) have shown that the crude protein extract from the leaves of *A. paniculata* inhibit the spore germination of two major pathogens *Aspergillus flavus and Macrophomina phaseolina.* The antifungal protein component further purified from the crude extract subjected to GC-MS analysis revealed phenols, aromatic carboxylic acids and esters to be the molecules responsible for the antimicrobial activity as assessed by measuring the diameter of the inhibition zones, MIC and MBC values (Roy *et al.,*2010).

Antiinflammatory activity: It has been reported that the ethyl acetate extract of *A. paniculata* significantly inhibit NF-κB luciferase activity and tumor necrosis factor α (TNF-α), interleukin-6 (IL-6), macrophage inflammatory protein-2 (MIP-2) and nitric oxide (NO) secretions from lipopolysaccharide (LPS)/interferon-γ stimulated Raw 264.7 cells as assessed by nuclear factor kappa B (NF-κB) driven luciferase assay (Chao *et al.,* 2009). Sulaiman *et al.* (2010), has reported that subcutaneous administration of andrographolide (10, 25, and 50 mg/kg) show significant antiedematogenic activity as assessed by the carrageenan-induced paw edema test. The extracts of *A. Paniculata* leaves has been found to be fairly potent in attenuating the inflammation by inhibiting proinflammatory (NO, IL-1 beta and IL-6), inflammatory (PGE2 and TXB2) and allergic (LTB4) mediators (Chandrasekaran *et al.,*2010).

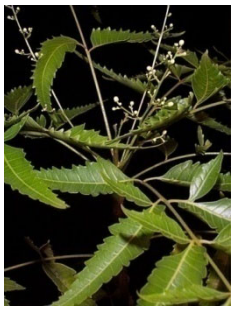
Hepatoprotective activity: Studies by Handa *et al*., (1990) has shown that the antihepatotoxic activity of andrographolide (100 mg/kg, i.p.) is comparable with that of the methanolic extract (861.33 mg/kg, i.p.) and andrographolide-free methanolic extract (761.33 mg/kg ip) of the plant. Further, andrographolide (100 mg/kg, ip) was also reported to normalize the carbontetrachloride induced increase in the pentobarbitone induced sleep time of mice, suggesting that andrographolide is the major active antihepatotoxic principle. Trivedi *et al* (2000) has reported that the aqueous extract of *A. paniculata* given orally (12 mg/kg) to the animals with liver damage induced by hexachlorocyclohexane (HCH) brought about a decline in the biochemical parameters such as serum alanine aminotransferase and aspartate aminotransferase and other parameters like alkaline phosphatase, glutathione and lipid peroxidase, suggesting significant hepatoprotective activity.

Antidiabetic activity: It has been reported that the oral administration of the ethanolic extract of *A. paniculata* at a dose of 1000 mg/kg increased the hypoglycemic responses to incremental dosing of exogenous insulin in streptozotocin-diabetic rats, thus improving the insulin sensitivity and delaying the development of insulin resistance, hence playing a role in amelioration of insulin resistance in patients (Subramanian *et al.,*2008).

Extraction & Isolation: The powdered plant material is extracted with methanol for 72h. The methanolic extract is concentrated in vacuo, diluted with water and fractionated into petroleum ether, dichloromethane and water soluble fractions. A portion of the dichloromethane soluble fraction is chromatographed on a column of silica gel eluted with chloroform and acetone mixture in order of increasing polarity. Fractions are collected and combined according to similar TLC pattern. Fractions of chloroform–acetone (9:1) are found to contain mixture of compounds 14-deoxy-11, 12-didehydroandrographolide and 14-deoxyandrographolide. Fractions of chloroform– acetone (8:2) are found to contain andrographolide (mp-228^{o}C). The mixture of 14-deoxy-11, 12-didehydroandrographolide (mp-203^{o}C) and 14-deoxyandrographolide (mp- 168^{o}C) is separated by repeated chromatography with mixture of chloroform and methanol. The above three compounds are identified with the help of spectral data (Kumar *et al.,* 2004).

Uses: The plant is bitter, acrid, cooling, laxative, vulnerary, antipyretic, antiperiodic, anti-inflammatory, expectorant, depurative, sudorific, anthelmintic, digestive and stomachic. It is useful in hyperdipia, burning sensation, wounds, ulcers, chronic fever, malarial and intermittent fevers, inflammations, cough, bronchitis, skin diseases, leprosy, intestinal worms, flatulence, diarrhea, haemorrhoids and vitiated conditions of pitta (Warrier, 2002)

3. AZADIRACHTA INDICA (MELIACEAE)



Hindi: Neem

Malayalam: Arya Veppu

Sanskrit : Nimba

Synonym: Neem.Parts used-leaves, bark, seeds, and flowers.

Chemistry: A new triterpenoid named nimbocinone, has been isolated from fresh, undried winter leaves of *Azadirachta indica* along with two sterols identified as sitosterol and stigimasterol (Siddiqui *et al.,*1986). Van*, et al.* (1991) has isolated gallocatechin, epicatechin, catechin and epigallocatechin from crude aqueous bark of the plant. The heartwood of *A. indica* yielded a new steroid (2*α*, 3*β*, 4*β* -trihydroxypregnan-16-one) and 2 known steroids (2*β*, 3*β*, 4*β* -trihydroxypregnan-16-one and 2*α*, 3*α*, 4*β* -trihydroxypregnan-16-one) (Siddiqui *et al.,* 2009).

Pharmacology:

Hepatoprotective activity: Chattopadhyay *et al*. (1992) has reported that *A. indica* leaf extract significantly decline the values of serum enzymes in comparison with normal control animals indicating that the degree of hepatic cell damage is of lesser magnitude in extract treated group. The ethanol extract of *A. indica* has been found to show significant reversal of biochemical, histological and functional changes induced by carbontetrachloride in rats when administered at a dose of 0.5 g and 1 g/kg p.o. (Mujumdar *et al.,*1998). It has been reported that administration of *A. indica* leaf extract (500 mg/kg, p.o.) increased the concentration of glutathione in liver and blood. The liver Na+K+-ATPase activity has been found to be significantly increased compared to the paracetamol treated control group. It has also been observed that the increased level of liver thiobarbutiric acid reactive substances of paracetamol treated animals to be significantly reduced in group of animals receiving both *A. indica* leaf extract and paracetamol (Chattopadhyay *et al.,* 2003).

Anticancer activity: It has been shown that on treatment with nimbolide, a limonoid present in leaves and flowers of the neem tree, result in dose and time dependent inhibition of growth of choriocarcinoma cells with IC_{50} values of 2.01 and 1.19 μM for 7 and 24 h respectively. It has also been found that the nimbolide-induced apoptosis is mediated by the mitochondrial pathway indicating a decrease in Bcl-2/Bax ratio with increased expression of Apaf-1 and caspase-3, and cleavage of poly(ADP-ribose) polymerase suggesting the antiproliferative and apoptosis inducing effects of nimbolide (Kumar *et al.,* 2009).

Antidiabetic activity: Mostofa *et al.* (2007) has found that the administration of aqueous extract of *A. indica* at the dose rate of 500 mg/kg and1g/kg body wt orally for 14 days significantly lower blood glucose in Streptozotocin (50 mg/kg bwt i.p.) induced diabetic rats compared with patent drug glimepride (100 mg/kg bwt) as assessed by Glucotrend kit. Studies by Chakrabortty *et al*., (2006) suggest that water soluble fractions separated from the crude leaf extract of *A. indica* lower hyperglycaemia in streptozotocin induced diabetes.

Antimicrobial activity: It has been shown that purified fraction (ethyl acetate:chloroform; 3:1) of methanolic and petroleum ether extracts of *A. indica* seed coat, has antifungal activity against *Aspergillus niger* and *Curvularia lunata* with a minimum inhibitory concentration of 250 ppm and 1000 ppm, respectively (Verma *et al.,*1998).

Antiinflammatory activity: Reports indicate that the water soluble part of alcoholic extract of *A. indica* leaves at a dose of 200 mg/kg, p.o., exert significant antiinflammatory activity in rats as assessed by cotton pellet granuloma assay. The extract was also found to significantly inhibit the biochemical parameters (Chattopadhyay *et al.,*1998). Nimbidin, a major active principle of the seed oil of *A. indica* has been found to significantly inhibit some of the functions of macrophages and neutrophils relevant to the inflammatory response following both *in vivo* and *in vitro* exposure at 5-25 mg/kg p.o in rats. It has also been found that nimbidin cause inhibition of migration of macrophages to their peritoneal cavities in response to inflammatory stimuli and also inhibit phagocytosis and phorbol-12-myristate-13-acetate (PMA) stimulated respiratory burst in these cells (Kaur *et al*., 2004).

Antifertility activity: Studies by Khillarea (2003) suggest that the aqueous extract of old and tender *A. indica* leaves immobilize and kill 100% human spermatozoa within 20 seconds, as assessed by Sander–Cramer test. Parshad *et al.* (1998) has shown that intraperitoneal injections of the steroidal extract of *A. indica* at a dose of 100 mg/kg body weight, result in impaired spermiogenesis, increase the number of headless spermatozoa and significantly decrease motility of cauda spermatozoa, leading to a decline in the fertility index. They also found that intake of 0.8% (w/v) aqueous neem leaf extract in drinking water for 7 weeks decrease serum testosterone but has no effect in the fertility index. Upadhyay *et al*., (1990) has reported that a single intrauterine application (100µl) of neem oil in female Wistar rats of proven fertility caused long-term and reversible blocking of fertility and the animals treated with neem oil showed a significant leukocytic infiltration in the uterine epithelium between days 3 and 5 post coitum, i.e. during the pre-implantation period. It has been shown that *A. indica* treated animals reduce the number of pregnancies as well as the litter size while control mice has been found to show 100%, fertility rate (Deshpande *et al.,*1980).

Extraction & Isolation: The dried *A. indica* powder is macerated in acetone at room temperature for 3 days and filtered. The dark green filtrate is evaporated under reduced pressure. The black gum residue is digested in hot hexane and the hexane solution is decanted. The process is repeated until the hexane washing appeared colorless. Methanol is added to the dark green residue and the mixture is kept in a refrigerator overnight. Then the newly formed crystal are filtered and washed with cold methanol resulting in white crystal. The white crystal is crystallized twice from dichloromethane:hexane (1:1) to obtain the colorless plate crystals of nimbolide (0.204%) (Markmee *et al.,*2003).

Uses: The plant is bitter, astringent, acrid, refrigerant, antiperiodic, demulcent, insecticidal, liver tonic, expectorant, astringent, anthelmintic. It is useful in vitiated conditions of pitta, hyperdepsia, leprosy, skin diseases, eczema, leucoderma, pruritus, intermittent and malarial fevers, wounds, ulcers, tumours, diabetes, inflammation, haemorrhoids, amenorrhoea, syphilis, bronchitis and hepatopathy (Warrier, 2002).

4. BACOPA MONNIERA Linn. (Scrophulariaceae)

Hindi Name : Brahmi, Nirbrahmi

Malayalam: Brahmi

Synonym: Brahmi. Parts used- Leaves and whole plant.

Chemistry: *Bacopa monnieri* is reported to contain dammarane-type triterpenoid saponins with jujubogenin or psuedojujubogenin as aglycone (Bhandari *et al*., 2009). It had been shown that the alcoholic extract of *B. monnieri* comprise of various types of saponin including bacopasaponin A, B, C, D, pseudojujubogenin, bacopaside I, II, II, IV and V. The plant is also reported to contain other ingredients such as brahmine, hydrocotyline, herpestine and monnierin (Kapoor *et al.,* 2009) and glycosides: asiaticoside, flavonoides, apigenin, letconin (Nadkarni1976).

Pharmacology:

Cognitive enhancement and neuroprotective effects: Uabundit *et al* (2010) has reported that the alcoholic extract of *B. monnieri* extract can mitigate the memory impairment and the degeneration of neurons in hippocampus animal model of Alzheimer's disease induced by AF64A (ethylcholine aziridinium ion). They have also observed that the alcoholic extract of the *B. monnieri* extract at a dose of 40 mg/kg improve acetylcholine and cerebral blood flow and the changes of cholinergic neuron densities in hippocampus, the area playing an important role on spatial memory. AF64A administration significantly increased the escape latency but decreased retention time and the plant extract treatment at dosage used in their study significantly decreased the escape latency.

Antimicrobial activity: Studies by kumar *et al*.(2008) show that diethyl ether extracts of aerial parts of *B. monnieri* has potent antimicrobial activity against *Staphylococcus aureus* at higher concentrations (300µg/ml) and ethanolic extract has more antifungal activity against *Candida albicans* and *Aspergillus niger* but aqueous extract has no inhibitory effect on the tested microorganisms. It has also been reported that the phytochemicals viz. betulinic acid, wogonin and oroxindin isolated from the aerial parts of *B. monnieri* show significant antifungal activity against the two fungi *Alternaria alternata* and *Fusarium fusiformis* (Chaudhuri *et al.,*2004).

Antidepressaant activity: Shen *et al.* (2009) reported that the methanol extract, ethyl acetate fraction and butanol fraction of *B. monniera* when administrated orally, significantly reduced the immobility times as assessed by forced swimming test and tail suspension test.

Antioxidant activity: It has been seen that the ethanol extract of *B. monniera* has significant anti-lipid peroxidation potential with IC_{50} value being 154.31 g/ml, which was comparable with the reference drug α-tocopherol. *In vivo* lipid peroxidation study has revealed that paracetamol treated rats show significant increase in malondialdehyde when compared with rats of normal control group (Ghosh *et al.,*2007).

Hepatoprotective activity: Studies by Ghosh *et al*. (2007) reported that the ethanol extract of *B. monnieri* aerial parts show significant hepatoprotective action as assessed by nitric oxide scavenging activity and superoxide radical scavenging activity. Oral administration of the extract (300 mg/kg, p.o) was found to exhibit significant reduction in paracetamol-induced increase in levels of GOT, GPT, ALP and bilirubin (total and direct) concentration.

Anticancer activity: It has been reported that ethanol extract and a saponin rich fraction show potent activity and Bacoside A show the maximum activity with a LC_{50} of 38.3µ g/mL as assessed by brine shrimp lethality (D'Souza *et al.*, 2002).

The antitumor activity of methanol extract of the whole plant of *B monniera* and four different fractions (petroleum ether, $CHCl_3$, EtOAc, and *n*-BuOH fractions) of the methanol extract were tested for their antitumor activity (Peng *et al,* 2009). Among the five crude samples, *n*-BuOH fraction has been found to have the highest activity. The dammarane triterpene saponins isolated from the *n*-BuOH fraction, bacopaside É and bacopaside VII, had potential antitumor effect against all the tested human tumor cell lines MDA-MB-231, SHG-44, HCT-8, A-549 and PC-3M in MTT assay *in vitro*, and showed 90.52 % and 84.13 % inhibition in mouse implanted with sarcoma S180 *in vivo* at the concentration of 50 µmol/kg, respectively.

Extraction & Isolation: Powdered *B. monnieri* is defatted with petroleum ether in a soxhlet apparatus. The defatted material is extracted with MeOH/H2O (1:1) in a percolator at room temperature. The combined MeOH percolations are concentrated followed by dilution with MeOH and kept overnight at room temperature. A deep green residue is precipitated, which is filtered, concentrated, dissolved in water, and partitioned with ethyl acetate and butanol, successively. The ethyl acetate and butanol fractions are dried under vacuum. The ethyl acetate fraction is subjected to column chromatography on Diaion HP-20 and eluted with pure water followed by increasing polarity of methanol. Fractions collected are sequentially combined on the basis of the TLC pattern. Fractions eluted with methanol/water (90:10), afford compound Bacopaside-XI as a white amorphous powder after crystallization in methanol (Bhandari *et al.,* 2009).

Uses: The plant is astringent, bitter, sweet, cooling, laxative, intellect promoting, anodyne, carminative, digestive, anti-inflammatory, anticonvulsant, cardiotonic, bronchodilator, diuretic, emmenagogue, sudorific, febrifuge and tonic. It is useful in vitiated conditions of kapha and vata, biliousness, neuralgia, inflammations, epilepsy, insanity, amentia, constipation, asthma, bronchitis, skin diseases, leprosy, leucoderma syphilis, dysmenorrhoea (Warrier, 2002).

5. BERBERIS ARISTATA D.C. (Berberdiaceae)

Hindi: Darhald

Malayalam: Maramanjal

Sanskrit: Daruharidra

Synonym: Indian Berberry, Tree Turmeric. Parts used- Roots, bark, and root bark.

Chemistry: The alkaloids present in the bark and root bark of *Berberis aristata* are berberine, berbamine, aromoline, karachine, palmatine, oxyacanthine and oxyberberine (www.himalayahealthcare.com/ *herbfinder/h_berber.htm)*. Root and wood contain a yellow alkaloid berberine. Root also contains palmitine, jatrorrhizine, columbamine, tetrahydropalmitine, berbamine, oxyberberine and oxyacanthine (Kapoor, 2005).

Pharmacology:

Antidiabetic activity: The antidiabetic property of the ethanolic *B. aristata* root extract at doses of 250 mg/kg bw and 500mg/kg bw was studied by Singh *et al* (2009). They found that the oral administration of the root extract for 14 days can reduce blood glucose level by 49.27% and 40.29%, respectively in 90 min in the diabetic group and improve the body weight comparable to standard drug glybenclamide. It has also been reported that the ethanol extract of root of *B. aristata* at doses of 71.42 and 100mg/kgbw, show a significant reduction of serum glucose, cholesterol and triglycerides, in alloxan induced diabetic rats as compared to diabetic control group and also increased the glucose tolerance as assessed by oral glucose tolerance test (Semwal *et al.,*2009). Shah *et al.* (2008) has observed that the ethanolic extract of bark of *B. aristata* cause a reduction in blood glucose level at the dose of 25 mg/kg and 50 mg/kg, in diabetic rats in a dose dependent manner as assessed by glucose tolerance test compared to glibenclamide (5 mg/kg).

Antiinflammatory activity: Studies show that topical application of *Curcuma longa* and *Berberis aristata* aqueous extracts in experimental uveitis in rabbit, result in significant anti-inflammatory activity, as evaluated by endotoxin induced uveitis. The anterior segment inflammation in control group has been found to be significantly higher than in both the extract treated groups as observed by clinical and histopathological grading (Gupta *et al.,* 2008). Studies by Shahid *et al.*, (2009) showed that alcoholic (50mg/100g) and aqueous extracts (50mg/100g) has good activity against acute inflammation with significant activity at two hours after carrageenin injection.

Antiplatelet aggregation activity: It has been shown that the alcohol extract of the root of *B. aristata* inhibits the PAF induced aggregation of platelets in rabbit in a dose dependent manner in the microgram range. It was also shown to inhibit the ^{3}H-PAF binding to rabbit platelets in a competitive manner (Tripathi *et al.,*1998).

Antimicrobial activity: Shahid *et al.*(2009) has found that the aqueous and alcoholic extract of fresh *B. aristata* roots, as well as aqueous extract of dried roots show wide antibacterial activity against *Escherichia coli*, *Salmonella typhimurium, Shigella dysenteriae* type 1 and *Vibrio cholerae* as assessed by the disc diffusion method. All the three extracts was found to have antifungal activity against the *Candida* and *Aspergillus* species tested, except *Candida krusei*. Reports also indicate that the alkaloid fractions derived from aqueous extract of the bark of *B. asiatica* show significant activity against a battery of microorganisms as assessed by disk diffusion and agar dilution methods (Bhandari *et al.,*2000).

Anticancer activity: Studies by Das *et al.,* (2009) show that the methanolic extract of *B. aristata* exposed to different concentrations have significant anti proliferative activity on HT29 cancer cell line as determined by microculture tetrazolium viability assay, compared to Cisplatin and it was also observed that *B. aristata* methanolic extract induces a concentration dependent inhibition of HT29 cells, with an IC_{50} value of 1.8964µg/ml after 72 h of incubation. Letašiová *et al* (2006) has reported that the Berberine present in *B. aristata* has significant antiproliferative activity on the human tumour U937 cell line and the murine melanoma B16 cell line growing *in vitro*. The melanoma B16 cells were much more sensitive to berberine treatment than the U937 cells. The value of IC100 was found to be below 100 µg/ml for the U937 cells and below 1 µg/ml for the B16 cells.

Hepatoprotective activity: Gilani *et al.* (2006) reported that the aqueous-methanol extract of *Berberis aristata* fruits (500 mg/kg) when administered orally, there was a reduction in the death rate to 10% against paracetamol- and carbontetrachloride -induced hepatic damage. Pre-treatment of rats with fruit extract (500 mg/kg, orally twice daily for 2 days) prevented the paracetamol (640 mg/kg) as well as CCl_4 (1.5 mL/kg)-induced rise in serum transaminases (GOT and GPT). Plant extract (500 mg/kg) has been found to cause significant prolongation in pentobarbital (75 mg/kg)-induced sleep as well as increase strychnine-induced lethality in mice suggestive of inhibitory effect on microsomal drug metabolizing enzymes.

Uses: The popular preparation of daruharidra, called Rasanjana prepared from the root bark is useful in infections of the ear like otitis media and can be used as a wash for piles. Externally, the wounds are dressed with the medicated oil of the decoction of *B. aristata* (Daruharidra). It reduces the pruritus also. Its ointment made with camphor and butter is applied to pimples and boils. Rasanjana mixed with honey is a useful application to abrasions and ulcerations of the skin and also useful in inflammatory conditions of eye. The gargles of rasanjana with water are beneficial in the ailments of the mouth and throat. Its enema is beneficial in leucorroea. Internally daruharidra is useful as hepato-stimulant and astringent and useful in treating anorexia, dysentery, hepatitis and liver disorders. As a blood purifier decoction of daruharidra and rasanjana is used in combination in the secondary stage of syphilis. Rasanjana is extremely valuable in bleeding piles. The decoction of herb helps reducing swellings in hepato-splenomegaly. It also useful when given with honey in jaundice. Daruharidra, as an adjunct, is effective in the treatment of obesity to reduce excessive fats. The decoction along with haridra, is a good anti-diabetic combination. It also effectively reduces the uterine inflammations, hence is a valuable medicament for leucorrhea and menorrhagia. The decoction also helps in healing the ulcers of the cervix. Rasanjana alleviates the diseases of the eye and ear, and has a lactodepurant property. It is very useful for remittent and intermittent fevers (*www.herbalcureindia.com/herbs/daruharidra.htm).*

6. BOERHAAVIA DIFFUSA Linn (Nyctaginaceae)

Hindi: Godhaparna

Malayalam: Talutama

Sanskrit: Punarnava

***Sy*nonym:** Punarnava. Parts used- Roots and leaves.

Chemistry: The plant reported to contain two novel quinolizidine type alkaloids, Punarnavine-1 and Punarnavine-2 (Nandi *et al.,*1974). Four new compounds were isolated from *Boerhavia diffusa* namely eupalitin 3-*O*-β-D-galactopyranosyl-(1'''→ 2'')-*O*-β-D-galactopyranoside, 3,3',5-trihydroxy-7-methoxyflavone, 4',7-

dihydroxy-3'-methylflavone and 3,4-dimethoxyphenyl-1-*O*-β-D-apiofuranosyl-(1"→3')-*O*-β-D-glucopyranoside (Maurya *et al.,* 2007). Roots contain the rotenoids boeravinone A, B, C2, D, F and punarnavoside has also been reported. The methanolic extract of root is reported to possess lignans such as liriodendrin and syringaresinol mono-B-D-glucoside. The benzene extract yielded boerhavine, a dihydroisofuranoxanthone (Elizabeth, 2002).

Pharmacology:

Anticancer activity: The methanol:chloroform fraction at 200 µg/ml from crude alcoholic extracts of *B. diffusa* root has been reported to significantly reduce cell proliferation with visible morphological changes in HeLa cells suggesting that the antiproliferative effect of the fraction could be due to inhibition of DNA synthesis in S-phase of cell cycle in HeLa cells. The fraction has been found to cause cell death via apoptosis as evident from DNA fragmentation and caspase-9 activation (Srivastava *et al.,* 2010). Two rotenoids isolated from *B. diffusa*, boeravinones G and H, have been found to potently inhibit the drug efflux activity of breast cancer resistance protein (BCRP/ABCG2), a multidrug transporter responsible for cancer cell resistance to chemotherapy (Belkacem *et al.,* 2007). Leyon *et al* (2005) has found that the aqueous methanol (3:7) extract of *B. diffusa* is effective in reducing the metastasis formation by B16F10 melanoma cells. Report by Bharali *et al* (2003) indicate that *B. diffusa* produce significant reduction in the incidence of tumor (25%) as evaluated by 7,12-dimethyl benz(a)anthracene (DMBA) induced skin papillomagenesis in male Swiss albino mice (6-7 weeks old).

Immunomodulatory activity: It has been reported that administration of Punarnavine, an alkaloid from *B. diffusa* can enhance the immune response against metastatic progression of B16F-10 melanoma cells in mice as revealed by enhanced natural killer (NK) cell activity, antibody-dependent cellular cytotoxicity, antibody-dependent complement mediated cytotoxicity and production of cytokines such as IL-2 and IFN-γ, using C57BL/6 mice model compared to the metastatic tumor-bearing control. Peaks of pro-inflammatory cytokines such as IL-1β, IL-6 and TNF-α has been found to be significantly lowered by Punarnavine administration compared to metastatic control (Manu *et al.*, 2007). Eupalitin-3-O–b-D-galactopyranoside isolated and purified from the ethanolic leaf extract of *B. diffusa* has been found to show selective immunosuppressive activity (Pandey *et al.,* 2005). Studies by Mehrotra *et al*. (2002) has shown the antilymphoproliferative activity of ethanolic extract of *B. diffusa* roots. They found that the extract at 10, 50, 100 and 500µg/ml concentrations had significant antiproliferative action in T cell mitogen phytohemagglutinin and concanavalin A-stimulated proliferation of human peripheral blood mononuclear cells (PBMC). It also inhibited the growth of several cell lines (monocytic, lymphoblastoid, fibroblast, erythroleukemic) of mouse and human origin at 100- and 500- µ g/ml concentrations.

Antidiabetic activity: Studies by Chude *et al*. (2001) have shown that oral administration of the aqueous leaf extract of *B. diffusa* produce non dose related decreases in blood glucose level in alloxan-induced diabetic rats. The hypoglycemic effect produced by the aqueous extract of *B. diffusa* leaves have been suggested to be due to the glycosides, flavonoids, tannins and saponins present in the extract. Pari *et al.* (2004) has reported that the aqueous extract of *B. diffusa* leaves, at a dose of 200mg/kgbw produced a marked decrease in blood glucose, reduction of glycosylated haemoglobin and an increase in total haemoglobin level in normal as well as in alloxan diabetic rats after 4 weeks treatment.

Antimicrobial activity: It has been reported that ethyl acetate extract of the *B. diffusa* root is having most effective antifungal property against *Microsporum gypseum, M. fulvum*. The maximum inhibition of mycelial growth has been observed for *Microsporum gypseum* followed by *Microsporum fulvum* (Agarwal *et al.,*2004).

Uses: The plant is bitter, astringent, cooling, anthelmintic, diuretic, aphrodisiac, cardiac stimulant, diaphoretic, emetic, expectorant, anti-inflammatory, febrifuge, laxative and tonic. It is useful in all types of inflammations, leucorrhoea, ophthalmia, lumbago, myalgia, scabies, cardiac disorders, jaundice, anaemia, cough, bronchitis and general debility (Warrier, 2002).

7. CENTELLA ASIATICA (L.) urban (umbelliferae)

Hindi: Manduki

Malayalam: Muttil

Sanskrit: Mandukaparni.

Parts used: Leaves.and whole plant,

Synonym: Brahmi/ Indian Pennywort

Chemistry: Studies on the chemical constituents of the aerial part of *Centella asiatica* have led to the isolation of three new compounds, named centellin, asiaticin and centellicin (Siddiqui *et al*., 2007). The active constituents present in the *C. asiatica* extract are triterpenes namely asiatic acid and asiaticoside (Inamdar *et al*., 1996). 3,5-Di-O-caffeoyl quinic acid, 1,5-di-O-caffeoyl quinic acid, 3,4-di-O-caffeoyl quinic acid, 4,5-di-O-caffeoyl quinic acid, and chlorogenic acid together with asiaticoside, kaempferol, quercetine, kaempferol-3-O-beta-D-glucoside and quercetin-3-O-beta-D-glucoside were also isolated from the methanol extract (Satake *et al*.,2007)

Pharmacology

Neuroprotective effect: The neuroprotective effects of *C. asiatica* has been reported against colchicine (15 μg/5 μL) induced memory impairment and oxidative damage as assessed by Morris water maze and plus-maze performance tests. It has been found that chronic treatment with *C. asiatica* extract (150 and 300 mg/kg, p.o.) for a period of 25 days, beginning 4 days prior to colchicine administration, can significantly attenuate colchicine-induced memory impairment and oxidative damage and significantly reverse colchicine administered increase in acetylcholinesterase activity (Kumar *et al.*, 2009). *C. asiatica* leaf extract has been reported to improve spatial learning performance and enhance memory retention in neonatal rats during growth spurt period and was also found to be efficient in enhancing hippocampal CA3 neuronaldendritic arborization in rats (Rao *et al.*, 2007 & Rao *et al.*, 2005). The Brahmi rasayana (100 and 200 mg kg^{-1} p.o.) when administered for eight successive days has been found to significantly improve learning and memory in young mice and reverse the amnesia induced by both scopolamine (0.4 mg kg^{-1} i.p.) and natural aging as assessed by elevated plus maze and passive-avoidance paradigm compared with standard nootropic agent piracetam (200 mg kg^{-1} i.p.). Brahmi rasayana has also been found to significantly decrease whole brain acetyl cholinesterase activity and may serve as a memory enhancer (Joshi *et al.,*2006).

Immunoprotective activity: Jayathirtha *et al* (2004) has reported that the methanol extract of the whole plant of *C. asiatica* (0.18% asiaticoside) exhibit an increase in the phagocytic index and total WBC count at five dose levels (dose-response relationship) ranging from 100 to 500 mg/kgbw as assessed by carbon clearance test, cyclophosphamide-induced myelosuppression assay and humoral antibody titer assay.

Cardioprotective effect: It has been found that *C. asiatica* offers significant cardio protective effect in adriamycin induced cardiomyopathy in rats (Gnanapragasama *et al.,* 2004).

Antimicrobial activity: Studies by Mamtha *et al*. (2004) has shown that the ethanolic extract of *C. asiatica* exhibit *in vitro* inhibition of growth of enteric pathogens such as 4 ATCC Standard bacterial strains [*Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923, *Vibrio parahaemolyticus* ATCC 17802 and *Pseudomonas aeruginosa* ATCC 27853] and 45 fresh clinical isolates like *Vibrio cholerae* 01, *V. cholerae* 0139, species of *Shigella, Salmonella typhimurium, Aeromonas hydrophila*, Entero-aggregative *E. coli* and *Candida albicans* at concentrations of 100, 200, 300 and 400 mg/ml as assessed by Punch well and agar dilution methods.

Antitumour activity: It has been reported that the aqueous extract of leaves of *C. asiatica* demonstrated a promising activity against human breast cancer (MDA-MB 231) and mouse melanoma (B16F1) (648.0 and 698.0 µg/mL, respectively) and the extract was not cytotoxic at the tested concentrations (up to 1,000µg/mL) towards the human lung carcinoma (A549) and normal hamster kidney (BHK-21) cell lines (Pittella *et al*., 2009). The methanolic *C. asiatica* extract has been found to show a dose dependent inhibition of cell proliferation and a concentration dependent decrease in cell viability in breast cancer

cells (MCF-7) on treatment with different concentrations of *C. asiatica* extract as assessed by MTT assay. The extract has been found to induce apoptosis in MCF-7 cells as indicated by nuclear condensation, increased annexin staining, loss of mitochondrial membrane potential and induction of DNA breaks identified by TUNEL reactivity. The other cell lines such as HeLa, HepG2 and SW480 we did not observe a concentration dependent decrease in cell viability. The methanolic extract and asiatic acid inhibited the proliferation of human breast cancer cell line MCF-7, in a concentration dependent manner compared to tamoxifen (Babykutty *et al*., 2008).

Uses: The plant is bitter, acrid, sweet, cooling, soporific, cardiotonic, nervine tonic, stomachic, carminative, antileprotic, diuretic and febrifuge and is useful in vitiated conditions of pitta, insomnia, cardiac debility, epilepsy, asthma, bronchitis, amentia, abdominal disorders, leprosy and fever. The leaves are useful in abdominal disorders due to dysentery in children (Warrier, 2002)

8. COMMIPHORA MUKUL (Burseraceae)

Hindi: Guggul

Malayalam: Gulgulu

Sanskrit: Gugguluh

Synonym: Guggul. Parts used-Guggul gum and essential oil.

Chemistry: The plant contains essential oils mainly myrcene, dimyrecene, polymyrcene, sterol such as Z- guggulusteron, E- guggulusteron, lignans such as guggullignan-I, guggullignan-II and guggulusteron-I (Anurekha *et al*., 2006). It has been reported to contain long chain aliphatic tetrols: octadecan-1,2,3,4-tetrol, eicosan-1,2,3,4-tetrol and nonadecan-1,2,3,4-tetrol. Cembrene–A and mukulol were isolated from gum resin (Elizabeth, 2002).

Pharmacology:

Hypolipidaemic activity: It has been reported that Guggul gum, a resin obtained from an ethyl acetate extract of *C. mukul,* possesses marked hypolipidaemic activity (Nityanand and Kapoor, 1973). In another study by the same group it has been found that a standardized fraction from this resin containing a mixture of lipid steroids and named as guggulipid, has been marketed as a new hypolipidaemic lipid lowering agent (Nityanand and Kapoor, 1984). It has been reported that chronic feeding of this drug (5 mg/kg, b.w.) in animals simultaneously fed with cholesterol (25 mg/kg, b.w.) for 30 days, caused lowering in the lipid and apoprotein levels of very low density and low density lipoproteins in experimental animals. Serum lipids has been found to be lowered by guggulsterone (50mg/kg, b.w.) in triton WR-1339 induced hyperlipaemia. Guggulsterone has been found to activate lipolytic enzymes in plasma and liver as well as stimulate receptor mediated catabolism of low density lipoprotein. The hypolipidaemic activity of this drug was reported to be mediated through inhibition of hepatic cholesterol biosynthesis, increased faecal bile acid excretion and enhanced plasma 1ecithin:cholesterol acyltransferase activity (Chander *et al*., 1996). Studies by Singh *et al.* (1994) has reported that the guggulipid decreased the total cholesterol level, the low density lipoprotein cholesterol (LDL), triglycerides and the total cholesterol/high density lipoprotein (HDL) cholesterol ratio from the postdiet levels, whereas the levels were unchanged in the placebo group in a randomized, double-blind fashion.

Anticancer activity: It has been reported that treatment of human head and neck squamous cell carcinoma (HNSCC) cell lines with guggulsterone demonstrated dose-dependent decrease in cell viability with EC_{50} ranging from 5 to 8 µM and also induced apoptosis and cell cycle arrest (Leeman *et al.,*2009). It has been reported that the viability of PC-3 cells, but not a normal prostate epithelial cell line, was reduced significantly on treatment with guggulsterone in a concentration-dependent manner and the expression of antiapoptotic proteins Bcl-2 and Bcl-xL was initially increased in guggulsterone-treated PC-3 cells but declined markedly following a 16 to 24-hour treatment with guggulsterone indicates that caspase-dependent apoptosis by guggulsterone is mediated in part by Bax and Bak (Singh *et al.*, 2005). Guggulsterone has been found to suppress DNA binding of NF-kappaB induced by tumor necrosis factor (TNF), phorbol ester, okadaic acid, cigarette smoke condensate, hydrogen peroxide and interleukin-1

(Shishodia *et al.,* 2004). In another study by Shishodia *et al.* (2007) it was found that guggulsterone suppressed the proliferation of cells through inhibition of DNA synthesis, producing cell cycle arrest in S-phase and this arrest correlated with a decrease in the levels of cyclin D1 and a concomitant increase in the levels of cyclin-dependent kinase inhibitor p21 and p27. Guggulsterone has been found to induce apoptosis as indicated by increase in the number of Annexin V and TUNEL positive cells, through the down-regulation of anti-apoptototic products. The apoptosis induced by guggulsterone was also indicated by the activation of caspase 8, bid cleavage, cytochrome C release, caspase 9 activation, caspase 3 activation, and PARP cleavage.

Uses: The gum is bitter, acrid, astringent, thermogenic, aromatic, expectorant, digestive, antihelmintic, anti-inflammatory, anodyne, antiseptic, nervine tonic aphrodisiac, liver tonic antispasmodic, diuretic rejuvenating and as general tonic. It is useful in vitiated conditions of vata, gout, facial paralysis, hemiplegia, leprosy, leucoderma, cough, asthma bronchitis, pectoral and hepatic disorders, epilepsy haemorrhoids, ulcers, cardiac disorders, coronary thrombosis, anaemia, stomatopathy, diabetes and skin diseases (Warrier, 2002).

9. CURCUMA LONGA Linn. (Zingiberaceae) same as item 20 on page 49

Hindi: Haldi

Malayalam: Manjal

Sanskrit: Haridra

Synonym: Turmeric. Parts used- Rhizome, and curcumin ointment.

Chemistry: Curcumin is the major active principle present as 2-5% dry weight in the rhizome of *Curcuma longa.* Other compounds which have been isolated from from this rhizome are curcumenone, curlone, bisdesmethoxycurcumin, cyclocurcumin, bis (parahydroxycinnamoyl) methane, Lalphacurcumene, curcumenol, curdione, dehydroturmeron and dihydrocurcumin. More than 20 components have been identified from the leaf oil of which the major monoterpenes are ά-phellandrene, 1,8-cineole, p-cymene and ß –pinene (Elizabeth, 2002).

Pharmacology

Antitumour activity: Kuttan *et al* (1987) has reported that the ethanolic extract of turmeric and a curcumin ointment can provide symptomatic relief in patients with cancers of oral cavity, breast, vulva and skin. It has been reported that natural curcuminoids, curcumin I, II and III isolated from turmeric cause inhibition of Ehrlich ascites tumour in mice. Curcumin III has been found to be more active than the other two as a cytotoxic agent indicating that curcumin III is the most active of the curcuminoids present in turmeric (Anto *et al.,* 1995). As antitumour agents, veratryl curcuminoid and salicyl curcuminoid has been found to increase the life span of animals by 100.6 and 86.9%, respectively, and all the synthetic curcuminoids have been found to be cytotoxic to cultured L929 cells and concentration needed for 50% inhibition was reported to be around 1µg/ml (Anto *et al.,*1996). It has been reported that tetradecanoylphorbol-13-acetate (TPA)-induced skin tumors can be inhibited by topical application of curcumin, and also that curcumin inhibit a variety of biological activities of TPA. Topical application of curcumin was also reported to inhibit TPA-induced c-fos, c-jun and c-myc gene expression in mouse skin (Limtrakul *et al.,*2001). Studies from our laboratory (Bava *et al*, 2005) has shown that a combination of 5 nm Taxol with 5 µm curcumin augments anticancer effects more efficiently than Taxol alone as evidenced by increased cytotoxicity and reduced DNA synthesis in HeLa cells. Furthermore, our results revealed that this combination at the cellular level augments activation of caspases and cytochrome C release. Evaluation of signaling pathways common to Taxol and curcumin revealed that the synergism is in part related to down-regulation of NF-κB and serine/threonine kinase Akt pathways by curcumin. The studies indicated that Taxol in combination with curcumin may provide a superior therapeutic index and advantage in the clinic for the treatment of refractory tumors. Cui *et al* (2006) has examined the effects of curcumin on cell growth and telomerase activity in human cancer cell lines Bel7402, HL60 and

SGC7901. They have found that curcumin (1-32μM) shows anti-proliferating effects on these cell lines in a dose-dependent manner *in vitro*. They also observed that curcumin (50-200 mg/kg) when administered orally to nude mice result in suppression of telomerase activity as observed by means of a telomeric repeat amplification protocol - silver staining assay, suggesting that curcumin could suppress telomerase activity in the cancer cell lines and that the decrease of telomerase expression followed by induction of apoptosis might be involved in the anti-proliferating effect of curcumin. Shi *et al.,* (2006) has reported that curcumin can significantly inhibit the growth and induce apoptosis in the human ovarian cancer cell line Ho-8910 as assessed by MTT assay, fluorescence microscopy, flow cytometry and Western blotting. A decrease in expression of Bcl-2, Bcl-X(L) and pro-caspase-3 was observed after exposure to 40μM curcumin, while the levels of p53 and Bax were increased in the curcumin-treated cells. It has also been reported that administration of curcumin after methotrexate treatment significantly decreased malondialdehyde level as compared to methotrexate alone treated group (Hemeida *et al*., 2008).

Analgesic activity: Dose dependent analgesic activity of curcuminols following intra-peritoneal administration in writhing, capsaicin and formalin rat model has been reported by Navarro *et al.* (2002). The analgesic activity of *C. longa* rhizome powder extract in human was also observed by Jaiswal *et al*. (2004). Prolonged reaction time to radiant heat stimulation and reduced number of writhing episode following JCICM-6 (polyherbal formulation containing *C. longa*) in mice has been reported by Zhou *et al.* (2006). It has also been reported that the aqueous and alcoholic extracts of *C. longa* at 100 and 200 mg/kg by oral, single dose treatment for seven days has significant difference in reaction time in terms of analgesic activity before and after treatments which was comparable to analgin (10 mg/kg bw). The aqueous extract at 200 mg/kg dose has been reported to show increase in mean reaction time in terms of analgesic activity which was significantly higher compared to other extracts. (Neha *et al.*,2009).

Antiinflammatory activity: The anti inflammatory activity of the total petroleum ether extract of the rhizome of turmeric and two of its fractions A and B has been reported by Arora *et al*.(1971). It was shown that the extract have significant anti-inflammatory activity compared with that of hydrocortisone acetate and phenylbutazone as assessed by cotton pellet method. It was also found that the antiinflammatory activity of the total petroleum ether extract was less than the individual fractions A and B. Two naturally occurring analogues of curcumin, Feruloyl 4-hydroxy cinnamoyl methane and bis-(4-hydroxycinnamoyl) methane isolated from the alcoholic extract of turmeric has been found to possess significant anti-inflammatory activity compared with sodium curcuminate and phenylbutazone using carrageenin-induced rat paw edema (Rao *et al.,*1982). It has been reported that the curcumin isolated from the rhizomes of the plant can inhibit arachidonic acid metabolism, cyclooxygenase, lipoxygenase, cytokines (interleukins and tumour necrosis factor) and release of steroidal hormones and also stabilize lysosomal membrane and have strong oxygen radical scavenging activity suggesting its antiinflammatory property. At a dose range of 100–200 mg/kg bw curcumin has been found to exhibit good antiinflammatory activity in various animal studies (Kohli *et al.,*2005).

Antidiabetic activity: Studies by Nishiyama *et al* (2005) has shown that the treatment with turmeric extracts suppressed the significant increase in blood glucose levels and also stimulated human adipocyte differentiation and both curcuminoids and sesquiterpenoids in turmeric exhibit hypoglycemic effects *via* PPAR-*ç (*peroxisome proliferator-activated receptor-*ç*) activation as one of the mechanisms.

Hepatoprotective activity: It has been reported that the turmeric antioxidant protein isolated from aqueous extract of turmeric has potential efficacy in protecting tissues from peroxidative damage as assessed by the carbon tetrachloride treated rats indicating normalized levels of antioxidant enzyme activities of superoxide dismutase, catalase, glutathione peroxidase, glutathione-S-transferase and antioxidant concentrations of reduced glutathione, total, protein and non-protein thiols and ascorbic acid in the liver of carbon tetrachloride treated rats (Subramanian *et al.,*1999). Studies by Somchit *et al* (2005) has reported that pretreatment with ethanol extract of *C. longa* (100 mg/kg) prior to paracetamol dosing lowered serum liver enzyme activities serum alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase as assessed by paracetamol induced liver damage in rats.It has been reported that curcumin soya lecithin complex afford a significantly higher protection against paracetamol-induced rise in serum aspartate aminotransferase and alanine aminotransferase levels as compared to pure curcumin. Treatment of animals with curcumin-soya lecithin complex at 50 mg/kg and 100mg/kg was shown to

provide a highly significant protection against paracetamol induced rise in serum AST levels and serum ALT levels as compared to pure curcumin at the respective doses (Kumar *et al.,*2008).

Antimicrobial activity: It has been reported that ethyl acetate, methanol and water extracts of *C. longa* showed significant antimicrobial activity against Methicillin-resistant *Staphylococcus aureus* (MRSA). The ethyl acetate extract of *C. longa* has been found to have a higher antibacterial activity than the methanol extract or water extract and the ethyl acetate extract of *C. longa* markedly lowered the MICs of ampicillin and oxacillin against MRSA and it has been shown that MRSA intracellular invasion was significantly decreased in the presence of 0.125-2 mg/mL of *C. longa* extract compared with the control group as assessed by bacterial invasion assay suggesting that the ethyl acetate extract of *C. longa* may have antibacterial activity and the potential to restore the effectiveness of beta-lactams against MRSA (Kim *et al*., 2005). Studies by Niamsa *et al* (2009) has shown that the aqueous extract of *C. longa* exhibited antimicrobial activity against *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC25923, *Krebsilla pneumoniae* ATCC 10031 and *Staphylococcus epidermidis* ATCC 12228 as assessed by agar diffusion method and the Minimum Inhibitory Concentration (MIC) determined using agar dilution and confirm with broth macrodilution methods.

Uses: The rhizomes are bitter, acrid, thermogenic, emollient, anodyne, anti-inflammatory, depurative, antiseptic, appetizer, carminative, stomachic, anthelmintic, laxative, diuretic, expectorant, haematinic, antiperiodic, febrifuge ophthalmic and tonic and are useful in vitiated conditions of kapha and pitta, inflammations, ulcers, wounds, leprosy, skin diseases, pruritus, allergic conditions and discoloration of the skin, anorexia, dyspepsia, flatulence, colic haemorrhages, fever, cough, asthma, bronchitis, epilepsy, gonorrhea, amenorrhoea, jaundice, conjunctivitis, general debility and diabetes (Warrier, 2002).

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MEDICINAL PLANTS FROM DALBERGIA TO DARCOCEPHALUM MOLDAVICA L; P FAIZEL LECTURE AND G.R SAJITHA RES. SCHOLAR DEPT. MED. BIOCHEMISTRY SCHOOL OF HEALTH SCIENCES, KANNUR UNIVERSITY PALAYAD CAMPUS THALASSERY 670 661. KERALA

1. DALBERGIA

Dalbergia sisso

Dalbergia is a large genus of small to medium-size trees, shrubs and lianas in the pea family, Fabaceae, subfamily Faboideae. The genus has a wide distribution, native to the tropical regions of Central and South America, Africa, Madagascar and southern Asia. The size of the genus is disputed, with different authorities citing between 100–600 species; ILDIS accepts 159 species.

Kingdom: Plantae

Class: Magnoliopsida

Order: Fabales

Family: Fabaceae

Genus: Dalbergia

Uses: The phytochemicals isolated from Rosewoods, leaves, roots and flowers have many medicinal effects. (See the next article)

Chemistry and Biological Activities of the Genus *Dalbergia* - A Review Neeru Vasudeva, Manisha Vats, SK Sharma, Satish Sardana Year : 2009 | Volume : 3 | Issue : 6 | Page : 307-319, Date of Web Publication 24-Feb-2010

Dalbergia *is* a genus of trees, shrubs and woody climbers widely distributed in tropical and sub- tropical regions. It possesses immense traditional application. Various species are widely used as analgesic, anti-inflammatory, antipyretic, antimicrobial, antidiarrheal, anti-ulcerogenic, anti-spermicidal, larvicidal and mosquito repellant in the traditional system of medicines. Chemical investigation has resulted in characterization and isolation of various phytoconstituents. This review is a compilation of chemical composition and biological activities of the various species of the genus *Dalbergia.*

The genus consists of 300 species and about 25 species occur in India. Many species of *Dalbergia* are important timber trees, valued for their decorative and often fragrant wood, rich in aromatic oils [1],[2] . Traditionally various species are reported to be used as aphrodisiac, abortifacient, expectorant, anthelmentic, antipyretic, appetizer, allays thirst, vomiting, burning sensation, cures skin diseases, ulcers, diseases of the blood, reduces obesity, used in leucoderma, dyspepsia, dysentery, for diseases of the eye and nose, syphilis, stomach troubles, leprosy, leucoderma, scabies and ringworm [3],[4] . The present paper is compilation of the phytoconstituents that have been identified in this genus with the traditional and reported biological activities viz; nature of chemical compounds like phenols, isoflavanoids, various forms of glycosides, chalcones, melannein, melanoxin, neoflavanoids, isovolubilin, volubulinin, dalbinol, sissonin, isocaviunin, paniculatin, (5-36), their chemistry and pharmacology like analgesic and anti inflammatory activities (37-47).

Phytoconstituents identified in the genus dalbergia.

A number of phytoconstituents namely flavonoids, isoflavonoids, glycosides, steroids, quinines etc., have been isolated from the various species of the genus. Phytoconstituents isolated from the genus *Dalbergia* are numerous.

Biological activities

Dalbergia genus possesses immense traditional application. So far, a few species have been screened for their biological activity and experimental results have shown a wide spectrum of such effects, the important ones are as follows:

Analgesic, antipyretic and anti-inflammatory activity

Alcoholic extract of *D. sisso* leaves have shown peripheral analgesic activity and central analgesic activity in various models viz; acetic acid induced writhings, hot plate method, tail-clip test in mice and Randoll-selitto assay. Similar activity has also been reported in ethanolic extract of *D. lanceolata* bark. The alcoholic extract of *D. sisso* leaves extract also showed antipyretic activity in Brewers yeast induced pyrexia in rats [48] . The ethanolic extract of *D. sisso* leaves significantly inhibited carragenin, kaolin, and nystatin induced paw edema as well as the weight of granuloma induced by the cotton pellet. It also inhibited dye leakage in acetic acid -induced vascular permeability test in mice [49] . Biochanin- A (5,7-dihyddroxy -4-methoxy isoflavone) isolated from flowers of *D. sissoids* have shown to possess anti -inflammatory activity against PGE, bradykinin, 5-HT and histamine induced rat hind paw odema in a dose dependent manner [50].

Anti arthritic activity

The petroleum ether, alcohol and aqueous extracts of *D. lanceolaria* had been found effective against arthritis when tested against formaldehyde-induced arthritis in young growing albino rats. The effects of extracts were comparable with cortisone, a standard anti-inflammatory and anti-arthritic drug [51].

Antimicrobial activity

Citric acid extract of the bark of *D. melanoxylon* have shown significant antibacterial activity against gram-negative bacteria *(Escherichia coli, Pseudomonas aeruginosa, Salmonella typhimurium and Yersinia pestis)* and gram-positive bacteria *(Bacillus subtilis, Klebsiella pneumoniae, and Staphylococcus aureus).* The plant has potential antifungal activity against *Candida albicans* and *Aspergillus niger* [52].

Antidiarrhoeal activity

The decoction of dried leaves of *D. sisso* possesses antidiarrhoeal activity. The ethanolic extract of the bark of *D. lanceolaria* have shown activity against castor oil and magnesium sulphate induced diarrhoea in albino mice [53].

Antiulcerogenic activity

The lyophilized aqueous extract (LAE) of *D. monetaria* have shown a dose dependant inhibition of gastric lesions induced by indomethacin, ethanol, pylorus ligature and hypothermic- restraint stress on oral administration [54] .

Larvicidal and mosquito repellant activity

The oil extracted from wood scrapings of *D. sisso* has shown dose dependent larvicidal activity, growth inhibitor and repellant action against *Anopheles stephensi, Ades aegypti* and *culex quinquefasciatus* [55]

Antigiarrdial activity

The extracts and formononetin an isoflavone from the bark of *D. frutescans* have shown significant activity against *Giardia intestinalis* with an IC_{50} value of 30ng/ml (approx. 0.1 μm) as compared to the value for metronidazole, the current drug of choice of 100 ng/ml (approx. 0.6 μm) [56]

Antiplasmodial activity

The flavanoids isolated from air dried powdered heartwood of *D. louvelli* showed antiplasmodial activity with IC_{50} values ranging from 5.8 to 8.7 um [57].

Antifertility activity

Triterpenoid glycosides, DSS, isolated from the root of *D.saxatilis* have shown antifertility activity in female wistar rats at the dose rate of 200mg/kg body weigtt at the premating period, inhibiting the conception in 71.4% of the treated animals. Fertility index was 107.82 compared to 373.5 for control rats [58].

Antioxidant activity

Butein isolated from *D. odorifera* have shown to inhibit the iron-induced lipid peroxidation in rat brain homogenate in a concentration dependant manner with an IC 50 value 3.3±0.4μm. It was as potent as α-tocopherol in reducing the stable free radical diphenyl-2-picarylhydryl (DPPH) with an IC 0.200 value 9.2±1.8 μm. It also inhibited the activity of xanthine oxidase with IC_{50} value 5.9±0.3μm. Butein scavenged the peroxyl radical derived from 2,2-azobis (2-amidinopropane) dihydrochloride (AAPH) in aqueous phase. Butein have also shown to inhibit copper-catalyzed oxidation of human lowdensity lipoprotein (LDL) in a concentration dependent manner. Butein caused endothelium dependant relaxation of rat aorta, precontracted with phenylephrine [59].

***Cancer chemopreventive* activity**

Ethanolic extracts of the stem bark of the *D. cultrate* Grati and *D. nigrescens* Kurz were found to exhibit a significant antitumor promoting activity on TPA (12-o-tetradecanoylphorbol-13acetase, EBV-EA (Epstein Barr virus early antigen) and TPAinduced EBV-EA activation [38].

Conclusion

The genus *Dalbergia* though known for its timber value also possesses significant medicinal properties. Most of the work carried out on the various species is on the extracts of the different parts. This review will help the future researchers to further explore the medicinal potential of the phytoconstituents of this genus.

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Antioxidant Activities of Natural Phenolic Components from *Dalbergia odorifera T. Chen*

Wen Wang, Xingchu Weng and Dongliang Cheng

Chemical Components and their Antioxidant Potency

The antioxidant activities of the oil of natural phenolic components extracted from *Dalbergia odorifera T. Chen* were investigated. A new benzophenone 2,4-dihydroxy-5-methoxybenzophenone (**1**), together with eight known components, were isolated. The eight components were identified by chemical and spectroscopic methods as 2′,3′,7-trihydroxy-4′-methoxyisoflavanone (**2**), 3′-methoxydaidzein (**3**), 4′,5,7-trihydroxy-3-methoxyflavone (**4**), vestitol (**5**), medicarpin (**6**), hexanoic acid, 2-propenylester (**7**), hexadecanoic acid, ethyl ester (**8**) and 3,8,-nonadien-2-one (**9**). Their antioxidant activities were investigated and compared with butylated hydroxyl toluene (BHT) and α-tocopherol. The results showed that components **1**, **3**, **5** and **6** had considerable antioxidant activity and components **2** and **4** had strong antioxidant activity at 0.02 and 0.04% levels. When the individual components (0.02%) were mixed with 0.02% BHT, or 0.02% α-tocopherol, their protection factor was increased, but there was no synergistic effect. When the individual component had 4 ppm added Fe^{3+}, components **1**, **2**, **3** and **4** showed antioxidant activity. Their antioxidant activities were tested by an oxidative stability instrument (OSI) at 100°C. Six of the phenolic components showed antioxidant activities

2. DATURA INOXIA OR DATURA METEL L.

Kingdom: Plantae

Order: Solanales

Family: Solanaceae

Datura is a genus of nine species of vespertine flowering plants belonging to the family Solanaceae.Common names include Thorn Apple (from the spiny fruit), Pricklyburr (similarly), Jimson Weed, Moonflower, Hell's Bells, Devil's Weed, Devil's Cucumber, and Devil's Trumpet, (from their large trumpet-shaped flowers). Nathaniel Hawthorne refers to one type in The Scarlet Letter as Apple-Peru. In Mexico, its common name is "Toloache". The word *datura* comes from the Hindi *Dhatūrā* (thorn apple); record of this name dates back to 1662 (OED). In Tamil it is called "oomathai". In Oriya it is called "Dudura

Today, experts classify only nine species of *Datura*:

- Datura ceratocaula Jacq.
- Datura discolor Bernh. – Desert Thorn-apple
- Datura ferox L. – Long Spined Thorn-apple
- Datura inoxia Mill. – Thorn-apple, Downy Thorn-apple, Indian-apple, Moonflower, Sacred Datura, Toloatzin, Toloache
- Datura leichhardtii F.Muell. ex Benth. (syn. *D. pruinosa*) – Leichhardt's Datura
- Datura metel L.
- Datura quercifolia Kunth – Oak-leaf Thorn-apple
- Datura stramonium L. (syn. *D. inermis*) – Jimsonweed, Thorn-apple

- Datura wrightii Regel – Sacred Datura, Sacred Thorn-apple
- American Brugmansia & Datura Society, Inc. (ABADS), is designated in the 2004 edition of the International Code of Nomenclature for Cultivated Plants as the official International Cultivar Registration Authority for *Datura*. This role was delegated to ABADS by the International Society for Horticultural Science in 2002.

Evaluation of Hypoglycemic and Antihyperglycemic Effects of *Datura metel* (Linn.) Seeds in Normal and Alloxan-induced Diabetic Rats

Journal of Ethnopharmacology
Volume 91, Issue 1, March 2004, Pages 95-98
B. Krishna Murthy, S. Nammi, M. K. Kota, R. V. Krishna Rao, N. Koteswara Rao and A. Annapurna

The seed powder of *Datura metel* was tested for its hypoglycemic activity in normal and alloxan-induced diabetic rats. Graded doses (25, 50 and 75 mg/kg, p.o.) of the seed powder when given to both normal and diabetic rats produced significant reduction in blood glucose at the 8 h. The effect was found to be dose dependent with all treatments at the doses administered.

The main chemical constituent is an alkaloid called scopolamine

Datura stramonium in asthma treatment and possible effects on prenatal development

Environmental Toxicology and Pharmacology Volume 21, Issue 3, May 2006, Pages 331-337

E. Pretorius and J. Marx

Chemical constituents and their actions

Southern Africa has a variety of medicinal plants, used as remedies; however, little information is available regarding the cytotoxic potential, particularly when used during pregnancy. One such plant is *Datura stramonium* (DS) (Solanaceae), used frequently for anti-asmatic treatment. DS contains a variety of alkaloids including atropine and scopolamine that can cause anticholinergic poisoning if taken in large doses. Atropine and scopolamine act on the muscarinic receptors by blocking them (particularly the M_2 receptors) on airway smooth muscle and submucosal gland cells. However, this will cause a continuous release in acetylcholine (Ach). Ach also act on nicotinic receptors; however, it is known that "over exposure" of nicotinic receptors may cause desensitization. We suggest that exposure of the foetus to DS when a mother uses it for asthma, will cause a continuous release of Ach, resulting in the desensitizing of nicotinic receptors, this could ultimately result in permanent damage to the foetus. Therefore we conclude that this African herbal remedy should be used with caution during pregnancy.

Hallucinogenic Effects of Aqueous Seeds Extract of Datura Metel In Rats.

The Internet Journal of Pharmacology. 2010 Volume 9 Number 1
M. G. Abubakar, U. Z. Suleiman, A.S. Faruk and A. N. Ukwuani

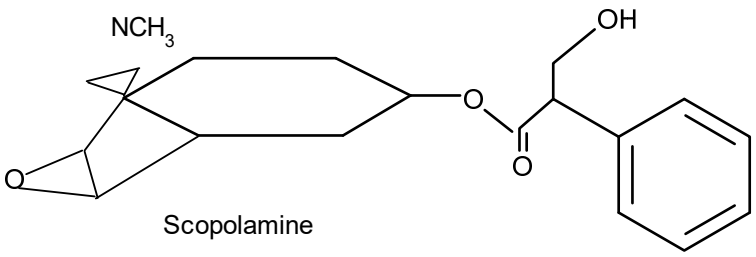
Chemical constituents and their actions

The hallucinogenic effect of aqueous seed extract of D. metel was evaluated. The ethanolic extract was subjected to Gas Chromatography Mass Spectrophotometry and the result shows the presence of an alkaloid scopolamine. Male wister rats were divided into four groups and were orally administered with aqueous seed extract of 0.0, 0.4, 0.6 and 0.8mg/kg body weight respectively. The treated groups exhibited some behavioral changes such as restlessness, aggressiveness, agitation and disorientation. The effect of the extract on the food and water intake shows a significant decrease ($p<.05$) in the 0.6 and 0.8mg/kg extract treated groups as compared with control. However, the heart rate increased significantly ($p<.05$) in 0.6 and 0.8mg/kg treated groups while the respiratory rate increased in the 0.8mg/kg treated group as compared with control respectively. A decrease of vitamin A, C and E was observed at all dose levels

particularly in 0.8mg/kg extract treated group ($p<.05$) at 3.27± 0.1, 4.08± 0.3 and 0.28± 0.04µg./dl respectively. The hallucinogenic effect observed may be due to the presence of the alkaloid scopolamine.

Gas chromatography mass spectrophotometry

Fig. 1.0 shows that, the GC-MS recorded the ethanolic seed extract of the D.metel to contain an alkaloid scopolamine.



Scopolamine

Hallucinogens are compound that caused hallucination. Hallucination is sensory experience of something that does not exist outside mind. It may involve distorted sensory perception so that things look sound, smell, or feel differently from the way they are. Although typically associated with psychiatric disorder, the hallucinatory experience has a wide range of etiologies that may include but not limited to the following: neurological insult, seizure and sleep disorders, drug reaction, substance abuse, grief, stress as well as metabolic, endocrine and infectious diseases (Hinsie and Campbell, 1970). The compound cause hallucination by mimicking or other wise affect neuro effectors junctions. Such agent exerts their influences in several ways; interference with the synthesis or release of the transmitter, interact with receptor and causes the destruction, dispersal or dissipation of transmitter (Wilhem, 1964).

GCMS result obtained recorded, that the ethanolic extract shows the presence of scopolamine. This scopolamine is structurally analogues to a neuro transmitter acetylcholine, and therefore inhibits the effect of the neuro transmitter. Acetylcholine is found in both peripheral nervous system (PNS) and in the central nervous system (CNS) as a neuro modulator (katzung, 2003).

Scopolamine competitively inhibit the acetylcholine at muscarinic acetylcholine receptors found in both peripheral and central nervous system (Foye et al.,1995). The decrease in locomotor activity immediately after extract administration as observed may be due to the inhibition of acetylcholine at M_3 receptors of the ending vagus nerves of the muscle. Normally acetylcholine is released when an exited neurons diffuses a few micrometers across the synaptic cleft or neuromuscular junction to the postsynaptic neuron or myocyte, where it interacts with it receptor and triggers electrical excitation (depolarization) of the receiving cell, depolarization of the muscle fibre triggers muscle contraction (Michael and David, 2005).

The emergence of pupil's dilatation treated groups shows the peripheral action of the extract even in lower dose which may be the paralysis of the oculomotor nerve ending or its myoneural junction.The dryness of the mouth of the treated animals suggest that, the extract have effect on submaxillary gland that control the secretion of saliva. Since muscarinic receptors when bound to acetylcholine in submaxillary gland stimulate gastric acid secretion, salivation and lacrimation (Foye et al., 1995). Therefore, the absence of saliva indicates the competitive activity of the extract on the gland.

The restlessness and hyperactivity exhibited by the treated animals serve as a marker for the action of the extract on central nervous system which comprises the brain and the spinal cord. Acetylcholine has effect on excitability of central nervous system (CNS), its presence causes a slow depolarization by blocking a tonically active K^+ current which increase neuronal excitability (Katzung,2004) while in the brain muscarinic receptor (M_5) is found in substantial nigra where it regulate dopamine release at terminals within the striatum (Foye et al., 1995). This could be probably the reason for Hallucination effects of the D. metel by affecting the dopamine release.

The food and water intake significantly ($P<0.05$) decrease with increase in the dose of the extract throughout the experiment as compared with control, indicating that, the extract suppress apatite. From the result the effect of extract on heart rate shows significant ($P<0.05$) increase with increase in the dose of the extract. Acetylcholine induces decreased contraction in cardiac muscle fibers by binding to its M_2

receptors found in cardiac muscle (Foye et al., 1995). But due to the presence of scopolamine, it inhibits the activity of the acetylcholine at the receptor and hence result in rapid heart beat.

The rate of respiration is also significantly ($P<0.05$) increased as compared with control. The increase in respiration is due to the Broncho dilation that occur when the alkaloid binds to the M_3 receptor on air way smooth muscles. In the airways acetylcholine is released from efferent ending of the vagus nerves and bind to the M_3 receptor there by mediating boroncho constriction (katzun,2004). The competitive inhibition of scopolamine to the acetylcholine results in broncho dilation hence increase in respiration.

The effect of extract on vitamin A, C, and E shows that the D. metel extract significantly ($P<0.05$) decreases the levels of these vitamins in the brain suggesting that the extract depletes these vitamins in the brain. Vitamin A, C and E are called antioxidants vitamin, they scavenge the oxygen free radicals which cause lipid peroxidation which causes delayed reversible demylinazation of white matter in the central nervous system, and can lead to edema and focal areas of necrosis within the brain (Gorman et al., 2003). Therefore, the potential of causing brain damage by the extract of D. metel has been significantly elucidated by the result of this study.

The findings of their research clearly validate the action of D.metel on central nervous system (CNS) and pheriparal nervous system (PNS) and this provide the evidence to support the use of such plant for medicinal, social or even rituals in the past.

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SEPARATION AND PARTIAL CHARACTERIZATION OF ISOLECTINS WITH DIFFERENT SUBUNIT COMPOSITIONS FROM *DATURA STRAMONIUM* SEEDS WILLEM F. BROEKAERT, ANTHONY K. ALLEN AND WILLY J. PEUMANS AVAILABLE ONLINE 19 OCTOBER 2001.

The lectin from *Datura stramonium* seeds was separated into three individual isolectins by hydrophobic-interaction chromatography on phenyl-Sepharose. Two of these isolectins are homodimers made up of two A- or two B-subunits, whereas the third is a heterodimer composed of one A- and one B-subunit. Analysis of the homodimeric AA- and BB-isolectins revealed that the A- and B-subunits have similar but

not identical M_r values (32 000 and 28 000, respectively), amino acid and carbohydrate compositions. The A-subunit has a higher affinity for *N*-acetyl-D-glucosamine oligomers than the B-subunit, whereas the latter is more specific for the carbohydrate determinants of some animal glycoproteins such as fetuin, asialofetuin and ovomucoid.

Chemical Composition: The seeds of Datura Stramonium contain the alkaloid *daturine*, said to be combined with malic acid (Brandes, 1821). It was first obtained pure and crystallized by Geiger and Hesse, in 1833, who also found it to occur in the leaves and the herb. It is now known to be a mixture of several alkaloids. Von Planta (1850) pronounced daturine to be identical with *atropine*, the principal belladonna alkaloid. Ladenburg (*Amer. Jour. Pharm.*, 1880, p. 368) differentiated daturine into atropine and *hyoscyamine*, the latter alkaloid predominating. E. Schmidt, however, contended that atropine predominates (*ibid.*, 1884, p. 440). It is accepted that *hyoscyamine* is the principal datura alkaloid; other alkaloidal constituents being *atropine* and *hyoscine*. (For the chemistry of these alkaloids, see *Atropina*, *Hyoscyamus*, and *Belladonna*.) The seeds of Datura Stramonium contain fatty oil (25 per cent), from which a new fatty acid, *daturic acid* ($C_{17}H_{34}O_2$), was isolated by Gérard (*Amer. Jour. Pharm.*, 1890, p. 493). It stands intermediate between palmitic and stearic acids. *Stramonin* is an indifferent, crystallizable, tasteless body, obtained from the seeds by Trommsdorff. As to the quantity of total alkaloids in various parts of the plant, Dr. A. R. L. Dohme (*ibid*., 1893, p. 482) concludes that the stems contain more alkaloid (0.3 to 0.4 per cent, volumetrically) than even the seeds (0.25 to 0.29 per cent), and the latter more alkaloid than the leaves (0.21 to 0.23 per cent, and 0.27 per cent for green leaves), etc. Herb gathered. in July and August contained more alkaloid than that collected in June (*ibid.*, 1894, p. 503, from *Proc. Amer. Pharm. Assoc.*). J. B. Nagelvoort (1897) finds the flowers of *Datura alba,* Linné, to contain a notable quantity of total alkaloids.

3. DAUCUS CAROTA LINN.

Kingdom: Plantae

Family: Apiaceae

Genus: Daucus

Species: D. carota

Daucus carota (common names include **wild carrot**, (UK) **bird's nest**, **bishop's lace**, and (US) **Queen Anne's lace**) is a flowering plant in the family Apiaceae, native to temperate regions of Europe, southwest Asia and naturalised to northeast North America and Australia; domesticated carrots are cultivars of a subspecies, *Daucus carota* subsp. *sativus*.

Daucus carota is a variable biennial plant, usually growing up to 1 m tall and flowering from June to August. The umbels are claret-coloured or pale pink before they open, then bright white and rounded when in full flower, measuring 3–7 cm wide with a festoon of bracts beneath; finally, as they turn to seed, they contract and become concave like a bird's nest. The dried umbels detach from the plant, becoming tumbleweeds.[1]

Very similar in appearance to the deadly Water Hemlock, *Daucus carota* is distinguished by a mix of bi-pinnate and tri-pinnate leaves, fine hairs on its stems and leaves, a root that smells like carrots, and occasionally a single dark red flower in its center.

Chemical Constituents

Falcarinol (Polyacetylene) isolated from carrot stimulated glucose uptake in normal and insulin –resistant primary porcine myotubes. (Bhattacharya, S; Rasmussen, M. Kerl. J. Biochem Pharmacol Res. 2: 91-98).

β carotene present in carrot reduces lung cancer in those with high plasma serum level. Carrot supplementation helps to protect LDL cholesterol from oxidation. From beta carotene Vit. A is formed by metabolism in the body. Beta carotene is a powerful antioxidant and it is a powerful booster of immune cells like NK cells. Red caroteneoids are lycopene and astaxaanthin, yellow carotenoids are lutein and

zeaxanthin. Carotenoids stimulate DNA repair enzymes, gives protection of cornea against UV lights better than lycopene.

Uses: Like the cultivated carrot, the wild carrot root is edible while young, but quickly becomes too woody to consume. A teaspoon of crushed seeds has long been used as a form of birth control; its use for this purpose was first described by Hippocrates over 2,000 years ago. Research conducted on mice has offered a degree of confirmation for this use—it was found that wild carrot disrupts the implantation process, which reinforces its reputation as a contraceptive.[2] Chinese studies have also indicated that the seeds block progesterone synthesis, which could explain this effect.

As with all herbal remedies and wild food gathering, extra caution should be used, especially since the wild carrot bears close resemblance to a dangerous species Water Hemlock. The leaves of the wild carrot can cause phytophotodermatitis, so caution should also be used when handling the plant.

The wild carrot, when freshly cut, will draw or change color depending on the color of the water it is in. Note that this effect is only visible on the "head" or flower of the plant. Carnation also exhibits this effect. This occurrence is a popular science experiment in primary grade school.

Queen Anne's lace

Wild carrot was introduced and naturalised in North America, where it is often known as "Queen Anne's lace". It is so called because the flower resembles lace; the red flower in the center represents a blood droplet where Queen Anne pricked herself with a needle when she was making the lace. The function of the tiny red flower, coloured by anthocyanin, is to attract insects.

The USDA has listed it as a noxious weed [3], and it is considered a serious pest in pastures. It persists in the soil seed bank for two to five years.[4]

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DAUCUS CAROTA

1. A study was conducted to evaluate the inotropic and cardioprotective effects of Daucus carota Linn.

Daucus carota Linn. tubers were extracted with water and analyzed for its inotropic and cardioprotective effects by measuring various biochemical parameters at the test doses of 250 and 500 mg/kg. Isoproterenol (5.25 mg/kg and 8.5 mg/kg) was administered subcutaneously on 29th and 30th day respectively in order to induce myocardial infarction. Cardiac tonicity was estimated by evaluating Na+K+ATPase, Mg2+ATPase and Ca2+ATPase levels in heart. The levels of Na+K+ATPase and Mg2+ATPase were decreased and that of Ca2+ATPase was increased in extract-treated group significantly ($p<0.001$). Cardioprotection was assessed by estimating serum aspartate transaminase, alanine transaminase, lipid peroxidase, and lactate dehydrogenase levels and cardiac total protein and lipid peroxidase, and lactate dehydrogenase. The levels altered by isoproterenol were restored

significantly by the administration of the extract. The result of the study implies that *D. carota* is a potential source to protect heart from myocardial infarction and to maintain its tonicity.(**See related papers below**)

Inotropic and cardioprotective effects of Daucus carota Linn. On isoproterenol-induced myocardial infarction

P. Muralidharan, G. Balamurugan and Pavan Kumar

Bangladesh J Pharmacol 2008; 3: 74-79

2. Another study conducted on albino rats revealed the antifertile effects of Daucus carota linn

EFFECT OF CHROMATOGRAPHIC FRACTIONS OF DAUCUS CAROTA LINN. (SEEDS) ON FERTILITY IN FEMALE ALBINO RATS

S. K. GARG and V. S. MATHUR

J.Repro.Fert. (1972) 31, 143-145

Daucus carota Linn., has been reported to possess antifertility activity (1). Garg & Garg (2) (1971a) reported encouraging antifertility activity in the alcoholic and aqueous extracts of the seeds of this herb in female albino rats. No work seems to have been done before on the chromatographic fractionation of the different extracts of the seeds of this herb. It was considered worthwhile to undertake this study and the different fractions obtained were tested for antifertility activity in female albino rats. The air-dried powdered seeds of Daucus carota Linn. were successively extracted with petroleum ether (b.p. 60 to 80\s=deg\C), 95% alcohol and distilled water in a Soxhlet apparatus. The extracts were evaporated to dryness under reduced pressure. The residues obtained from the petroleum ether and alcoholic extracts were dissolved in a minimal quantity of petroleum ether and alcohol, respectively, and were chromatographed separately over Chromatographic alumina (Brockmann; E. Merck). The amount of alumina used in the column was 20 g/g of the crude extract to be chromatographed. The different fractions were collected by eluting the column successively with petroleum ether, benzene, chloroform, methanol and their mixtures. The aqueous extract was dissolved in a minimal quantity of distilled water and was successively extracted with chloroform and ethyl acetate. The solvents were stripped off from all these fractions. The different fractions so obtained with different extracts were converted into dosage forms by making a suspension in gum acacia and were tested for antifertility activity in female albino rats according to the method described earlier (Garg & Garg, 1971b) (3) which would detect any anti-zygotic, blastocystotoxic, anti-implantation or early abortifacient activity. The only parameter which would not be detected by this method would be its potential anti-ovulatory activity.

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Carrot seed essential oil information

Carrot seed oil is extracted from Daucus carota of the Apiaceae family and is also known as wild carrot and Queen Anne's lace. This is the essential oil extracted from the seeds and should not be confused with a macerated oil made when people infuse the carrot material in a base oil.

Chemical composition

The main chemical constituents of carrot seed oil include a-pinene, camphene, b-pinene, sabinene, myrcene, y-terpinene, limonene, b-bisabolene, geranyl acetate and carotol.

4. DENDROBIUM

Dendrobium nobile

Kingdom: Plantae

Division: Magnoliophyta

Order: Asparagales

Family: Orchidaceae

Genus: Dendrobium

Chemicals Present: Syringic acid and a polysaccharides

Dendrobium is a huge genus of orchids. It was established by Olof Swartz in 1799 and today contains about 1,200 species. The genus occurs in diverse habitats throughout much of south, east and southeast Asia, including the Philippines, Borneo, Australia, New Guinea, Solomon Islands and New Zealand. The name is from the Greek *dendron* ("tree") and *bios* ("life"); it means "one who lives on trees", or, essentially, "epiphyte".

NB: Syringic acid provide protection from D-gal. induced damage to rat eye lens. Polysaccharides exhibited hypoglycemic action in alloxan diabetic rats.

Uses by humans: Some *Dendrobium* species are grown as medical plants. The Noble Dendrobium (*D. nobile*) for example is one of the 50 fundamental herbs used in traditional Chinese medicine, where it is known as *shí hú* or *shí hú lán*.

Many species and cultivars of this genus are well-known floral emblems and have been figured in artwork. * 1) wei, X, Chen, D.et al Evidence based compliment. Altern Med. 2012 Article ID 426537, 13 pages. 2) Pan, L.H; Li, X.F et al. Int. J. Biol Macrol. 64 (2014) 420-427.

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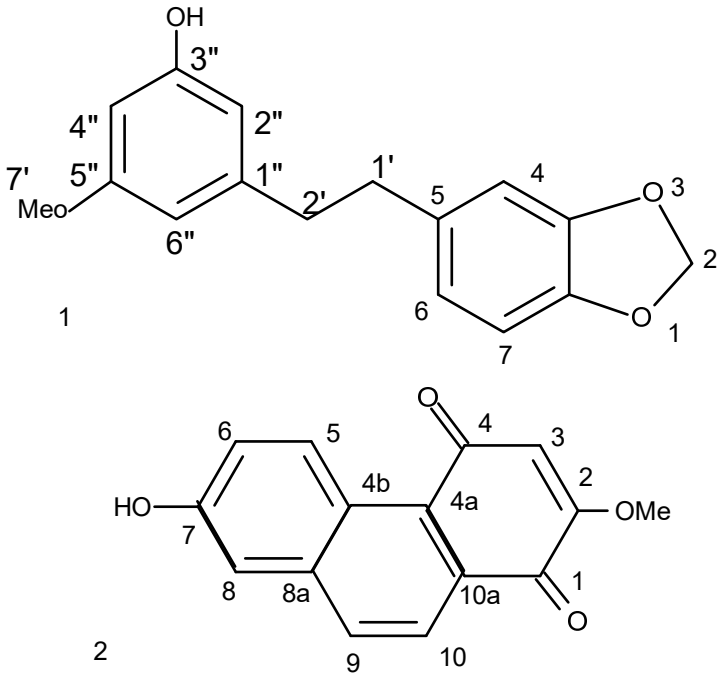
Chemical constituents from *Dendrobium densiflorum*

Chengqi Fan, Wei Wang, Yiping Wang, Guowei Qin and Weimin Zhao

Chemical constituents

5-[2′-(3″-Hydroxy-5″-methoxyphenyl)-ethyl]-1,3-benzodioxole and 7-hydroxy-2-methoxy-1,4-phenanthrenedione, along with 16 known compounds were identified from the stems of *Dendrobium densifiorum* Lindl. ex Wall. (Orchidaceae). The structure of a previously reported compound dendroflorin obtained from the plant was revised on the basis of spectroscopic analysis. Among the identified compounds, five were found to exhibit anti-platelet aggregation activity in vitro.

A bibenzyl (**1**) and a phenanthrenedione (**2**), along with 16 known compounds were identified from stems of *Dendrobium densiflorum* (Orchidaceae). Among them, five were found to exhibit anti-platelet aggregation activity in vitro.



5. DESMODIUM

Desmodium styracifolium

Kingdom: Plantae

Family: Fabaceae

Genus: Desmodium

Desv.

Desmodium is a genus in the flowering plant family Fabaceae, sometimes called **tick-trefoil**, **tick clover** or **beggar lice**.

Uses: Several *Desmodium* species contain potent secondary metabolites. They are used aggressively in agriculture as part of the push-pull technology. Tick-trefoils produce extremely high amounts of antixenotic allomones - chemicals which repel many insect pests - and allelopathic compounds which kill weeds. For example, *D. intortum* and *D. uncinatum* are employed as groundcover in maize and sorghum fields to repel *Chilo partellus* stem-borer grass moths. They also suppress witchweeds such as Asiatic Witchweed (*Striga asiatica*) and Purple Witchweed (*S. hermonthica*).

Tick-trefoils are generally useful as living mulch and as green manure, as they are able to replenish soil fertility due to their nitrogen fixation. Most also give good animal fodder.

Some *Desmodium* species were shown to contain elevated amounts of tryptamine alkaloids. This is widespread in this genus and its relatives, and many tryptamine-containing plants treated in *Desmodium* are not placed herein anymore (see also below).

Chemical constituents and medicinal uses.

Dimethyl tryptamine and their derivatives(DMT and 5-MeO-DMT)have been shown to occur in all green parts of *D. gangeticum*, as well as the roots. *D. triflorum* roots contain DMT-N-oxide.

There do not appear to be many animals that regularly feed on *Desmodium*, but detailed research in these interesting plants is lacking. Lesser Grass Blue (*Zizina otis*) caterpillars are known to feed in tick-trefoil, as well as, occasionally, those of the Two-barred Flasher (*Astraptes fulgerator*).

Desmodium gangeticum is widely used in the indigenous system of medicine in India and is reported to contain flavone and isoflavonoid glycosides. It forms the ingredient of many Ayurvedic formulations used for diabetes. A study was aimed at evaluating the insulin secretion and antidiabetic activity of Desmodium gangeticum. Treatment of diabetic rats with aerial parts of D. gangeticum extract (DG, 100 and 250 mg/kg body weight) for 3 weeks showed a significant reduction in blood glucose. D. gangeticum extract caused a significant increase in insulin secretion from MIN6 cells grown as monolayers and as pseudoislets, indicating that the antidiabetic activity may be as a result of increased insulin secretion. It also had a role on the lipid profile of the rats by causing reductions in cholesterol and triglycerides and increasing the HDL significantly ($p < 0.05$). This work supports the traditional use of D. gangeticum in the treatment of diabetes and this is likely to be due, at least in part, to its stimulation of insulin secretion by pancreatic islet cells. (Planta Med. 2007 May;73(5):427-32. Epub 2007 Apr 12.Govindarajan R, Asare-Anane H, Persaud S, Jones P, Houghton PJ. Department of Pharmacognosy and Ethnopharmacology, NBRI Lucknow, India. Effect of Desmodium gangeticum extract on blood glucose in rats and on insulin secretion in vitro.)

Studies on the Chemical Constituents of *Desmodium styracifolium*

(Osbeck) Merr.

Yuying Lin, Lingyi Kong*

To investigate the chemical constituents of *Desmodium styracifolium* (Osbeck) Merr. The compounds were

isolated by column chromatography on silica gel, Sephadex LH-20 and HPLC. Their structures were

identified by their physicochemical properties and spectral data. Thirteen compounds were isolated and

identified as vicenin 1 (1), vicenin 2 (2), vicenin 3 (3), schaftoside (4), isovitexin (5), genistin (6), chrysoeriol (7),luteolin (8), salic acid (9), gentisic acid (10), orbicularin (11), uracil (12) and allantoin (13). Compounds 2, 6, 7, 9~13 were isolated from this plant for the first time.

INTERNATIONAL LEGUME DATABASE & INFORMATION SERVICE (ILDIS) (2005): Genus *Desmodium*. Version 10.01, November 2005. Retrieved 2007-DEC-17.

Introduction

Desmodium styracifolium is a half-shrub herb, distributed in Fujian, Guangdong,

Guangxi and Hunan provinces in southern China. The whole plant is used as a specific medicine to treat cholestylithiasis and urolithiasis. Recent pharmacological studies have shown that its total flavonoids ingredients can increase coronary flow, and reduce blood pressure, myocardial consumption of oxygen and coronary artery resistance [1,2]. To establish quality criteria for *D. styracifolium*, we systematically investigated its chemical composition and isolated 13 compounds as vicenin 1 (1), vicenin 2 (2), vicenin 3 (3), schaftoside (4), isovitexin (5), genistin (6), chrysoeriol (7), luteolin (8), salic acid (9), gentisic acid (10), orbicularin (11), uracil (12) and allantoin (13), among which compounds 2, 6, 7, 9-13 were isolated from this plant for the first time.

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6. DIGITALIS

Kingdom: Plantae

Order: Lamiales

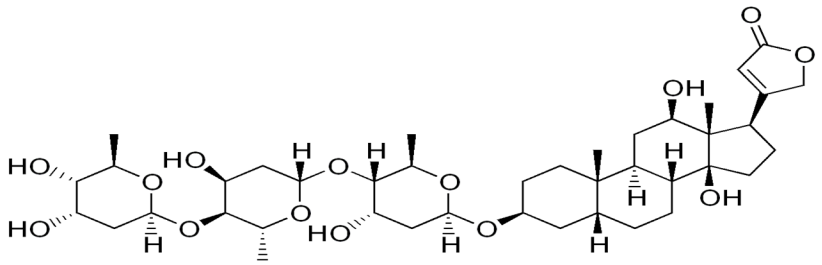
Family: Plantaginaceae[1]

Genus: Digitalis L.

Digitalis purpurea

Digoxin structure is shown below

Chemicaal name of digoxin: 4-[(3S,5R,8R,9S,10S,12R,13S,14S)-3-[(2S,4S,5R,6R)-5-[(2S,4S,5R,6R)-5-[(2S,4S,5R,6R)-4,5-dihydroxy-6-methyl-oxan-2-yl]oxy-4-hydroxy-6-methyl-oxan-2-yl]oxy-4-hydroxy-6-methyl-oxan-2-yl]oxy-12,14-dihydroxy-10,13-dimethyl-1,2,3,4,5,6,7,8,9,11,12,15,16,17-tetradecahydrocyclopenta[a]phenanthren-17-yl]-5H-furan-2-one ***Digitalis*** (pronounced /ˌdɪdʒɪˈteɪlɪs/)[2] is a genus of about 20 species of herbaceous perennials, shrubs, and biennials that are commonly called **foxgloves**. The genus was traditionally placed in the figwort family Scrophulariaceae, but upon review of phylogenetic research, it has now been placed in the much enlarged family Plantaginaceae.[1] The genus is native to Europe, western and central Asia, and northwestern Africa. The scientific name means "finger-like" and refers to the ease with which a flower of *Digitalis purpurea* can be fitted over a human fingertip. The flowers are produced on a tall spike, are tubular, and vary in colour with species, from purple to pink, white, and yellow. The best-known species is the Common Foxglove, Digitalis purpurea. It is a biennial, often grown as an ornamental plant due to its showy flowers, that range in colour from purples through to whites, with variable marks and spotting. The first year of growth produces only the long, basal leaves. In the second year, the erect leafy stem 0.5-2.5 m tall develops. The larvae of the Foxglove Pug feed on the flowers of *Digitalis purpurea*. Other Lepidoptera species feed on the leaves, including Lesser Yellow Underwing.



The term **digitalis** is also used for preparations containing cardiac glycosides, particularly digoxin, extracted from plants of this genus.

Medicinal uses

Medicines from foxgloves are called "Digitalin". The use of Digitalis purpurea extract containing cardiac glycosides for the treatment of heart conditions was first described in the English speaking medical literature by William Withering, in 1785,[3] which is considered the beginning of modern therapeutics (Silverman)[4][5] It is used to increase cardiac contractility (it is a positive inotrope) and as an antiarrhythmic agent to control the heart rate, particularly in the irregular (and often fast) atrial fibrillation. It is therefore often prescribed for patients in atrial fibrillation, especially if they have been diagnosed with heart failure.

Chemical Compounds

A group of pharmacologically active compounds are extracted mostly from the leaves of the second year's growth, and in pure form are referred to by common chemical names such as digitoxin or digoxin, or by brand names such as *Crystodigin* and *Lanoxin*, respectively. The two drugs differ in that Digoxin has an additional hydroxyl group at the C-3 position on the B-ring (adjacent to the pentane). Both molecules include a lactone and a triple-repeating sugar called a glycoside.

Mechanism of action

Digitalis works by inhibiting sodium-potassium ATPase. This results in an increased intracellular concentration of sodium, which in turn increases intracellular calcium by passively decreasing the action of the sodium-calcium exchanger in the sarcoplasmic reticulum. The increased intracellular calcium gives a positive inotropic effect. It also has a vagal effect on the parasympathetic nervous system, and as such is used in reentrant cardiac arrhythmias and to slow the ventricular rate during atrial fibrillation. The dependence on the vagal effect means that digitalis is not effective when a patient has a high sympathetic nervous system drive, which is the case with acutely ill persons, and also during exercise.

Digitalis toxicity (*Digitalis intoxication*) results from an overdose of digitalis and causes anorexia, nausea, vomiting and diarrhea, as well as sometimes resulting in xanthopsia (jaundiced or yellow vision) and the appearance of blurred outlines (halos). Bradycardia also occurs. Because a frequent side effect of digitalis is reduction of appetite, some individuals have used the drug as a weight loss aid.

Digitalis is an example of a drug derived from a plant formerly used by folklorists and herbalists: herbalists have largely abandoned its use because of its narrow therapeutic index and the difficulty of determining the amount of active drug in herbal preparations. Once the usefulness of digitalis in regulating pulse was understood, it was employed for a variety of purposes, including the treatment of epilepsy and other seizure disorders, now considered inappropriate.

Toxicity

Depending on the species, the digitalis plant may contain several deadly physiological and chemically related cardiac and steroidal glycosides. Thus, the digitalis has earned several more sinister names: *Dead Man's Bells*, and *Witches' Gloves*.

The entire plant is toxic (including the roots and seeds), although the leaves of the upper stem are particularly potent, with just a nibble being enough to potentially cause death. Early symptoms of ingestion include nausea, vomiting, diarrhea, abdominal pain, wild hallucinations, delirium, and severe headache. Depending on the severity of the toxicosis the victim may later suffer irregular and slow pulse, tremors, various cerebral disturbances, especially of a visual nature (unusual colour visions with objects

appearing yellowish to green, and blue halos around lights), convulsions, and deadly disturbances of the heart. For a case description, see the paper by Lacassie.[6]

There have been instances of people confusing digitalis with the relatively harmless Symphytum (comfrey) plant (which is often brewed into a tea) with fatal consequences. Other fatal accidents involve children drinking the water in a vase containing digitalis plants. Drying does not reduce the toxicity of the plant. The plant is toxic to animals including all classes of livestock and poultry, as well as felids and canids.

Digitalis poisoning can cause heart block and either bradycardia (lowered heart rate) or tachycardia (increased heart rate), depending on the dose and the condition of one's heart. It should however be noted, that electric cardioversion (to "shock" the heart) is generally not indicated in ventricular fibrillation in digitalis toxicity, as it can increase the dysrhythmia in digitalis toxicity. Also, the classic drug of choice for VF (ventricular fibrillation) in emergency setting,[7] amiodarone (Cordarone) can worsen the dysrhythmia caused by digitalis, therefore, the second-choice drug Lidocaine is more commonly used.

Use in molecular biology as digoxigenin

Digoxigenin (DIG) is a steroid found exclusively in the flowers and leaves of the plants Digitalis purpurea and Digitalis lanata. It is used as a molecular probe to detect DNA or RNA. It can easily be attached to nucleotides by chemical modifications. DIG molecules are often linked to uridine nucleotides; DIG labeled uridine (DIG-U) can then be incorporated into RNA probes via in vitro transcription. Once hybridisation occurs *in situ*, RNA probes with the incorporated DIG-U can be detected with anti-DIG antibodies that are conjugated to alkaline phosphatase. To reveal the hybridised transcripts, alkaline phosphatase can be reacted with a chromogen to produce a colour precipitate.

Footnotes

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2. ^ OED*:* "Digitalis"
3. ^ Goldthorp WO (2009). "Medical Classics: An Account of the Foxglove and Some of its Medicinal Uses by William Withering, published 1785". *Brit Med J* **338**: b2189.
4. ^ In contemporary medicine, a purer form of digitalis (usually digoxin) is obtained from *Digitalis lanata.*
5. ^Digoxin comes from Digitalis lanata. Hollman A. *BMJ* 1996;312:912. online version accessed 18 ^ Oct 2006 [1]
6. ^ A non-fatal case of intoxication with foxglove, documented by means of liquid chromatography-electrospray-mass spectrometry. Lacassie E et al., *J Forensic Sci.* 2000 Sep;45(5):1154-8. Abstract accessed online 19 Sep 2006. [2]
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Studies on Digitalis XIV: Influence of Cardiac Norepinephrine Stores on the Response of Isolated Heart Muscle to Digitalis

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An invitro study using isolated papillary muscles of cat's heart

On the basis of studies on cardiac tissue removed from animals treated with antiadrenergic drugs, a number of investigators have suggested that the positive inotropic response to digitalis requires norepinephrine in the cardiac muscle. In the present study the action of strophanthidin was studied in isolated papillary muscles obtained from normal cat hearts, from chronic, totally cardiac-denervated, norepinephrine-depleted hearts, and from reserpine-treated, norepinephrine-depleted cats. Complete force-velocity and length-tension curves were recorded. Following the addition of strophanthidin (1.0µg/ml) to the bath, maximum isometric tension rose by averages of 2.17 ± 0.32 g/mm^2 in the normal muscles and 2.65 ± 0.50 g/mm^2 in the muscles from the denervated cats, but increased significantly less ($P < 0.05$) in the muscles from the reserpine-treated animals (1.09 ± 0.36 g/mm^2). In addition to these changes in isometric tension, strophanthidin increased the maximum velocity of contraction (V_{max}) to a comparable extent in normal and denervated muscles, with a smaller elevation of V_{max} in reserpine-treated muscles. Strophanthidin reduced the absolute refractory period to an equal extent in all three groups of muscles. From a comparison of the inotropic responses of the muscles from normal and cardiac-denervated cats it is concluded that cardiac norepinephrine stores and neural integrity are not essential for the positive inotropic effect of strophanthidin or for its effects on the duration of the absolute refractory period. However, it appears that prior reserpine treatment may interfere with the inotropic response to digitalis by a mechanism other than norepinephrine depletion

7. DILLENIA INDICA L.

Kingdom: Plantae

Class: Magnoliopsida

Family: Dilleniaceae

Genus: Dillenia

DR. M. Krishnan Nair said "Vegetarians get intestinal cancer very rarely only".

I dedicate this part of thebook to memories of Late Dr. M.Krishnan Nair (82) who passed away on 28th October 2021. He was the founder of RCC in Trivandrum and took part in conferences along with me for the awareness on cancer. **Editor**

Bionomial Name: Dillenia indica L

Dillenia indica (**Chulta**) is a species of *Dillenia* native to southeastern Asia, from India, Bangladesh and Sri Lanka east to southwestern China (Yunnan) and Vietnam, and south through Thailand to Malaysia and Indonesia.[1]

It is an evergreen large shrub or small to medium-sized tree growing to 15 m tall. The leaves are 15-36 cm long, with a conspicuously corrugated surface with impressed veins. It's branches are used to make good firewood. The flowers are large, 15-20 cm diameter, with five white petals and numerous yellow stamens. It's characteristics round fruit are large,greenish yellow,have many seeds and are edible. The fruit is a 5-12 cm diameter aggregate of 15 carpels, each carpel containing five seeds embedded in an edible pulp.[2][3]

The fruit pulp is used in Indian Cuisine in curries, jam, and jellies.[2]

It is known as *outenga* in Assamese, *chalta* in Bengali

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DILLENIA INDICA

Evaluation of Phytochemical and Pharmacological Properties of *Dillenia indica* Linn. Leaves

Bose, U., K. Gunasekaran, V. Bala and A.A. Rahman, 2010. Evaluation of phytochemical and pharmacological properties of *Dillenia indica* Linn. leaves. J. Pharmacol. Toxicol., 5: 222-228.

The crude methanol extract of the roots of *Dillenia indica* Linn. (Family: Dilleniaceae) was investigated for its possible analgesic, antidiarrhoeal and GI motility tests in animal models. The extract produced significant writhing inhibition in acetic acid-induced writhing in mice at the oral dose of 250 and 500 mg kg^{-1} b.wt. ($p<0.01$) comparable to the standard drug diclofenac sodium at the dose of 25 mg kg^{-1} of body weight. The crude extract produced significant antidiarrhoeal effect at the dose of 500 mg kg^{-1} of body weight comparable to that produced by loperamide, used as standard drug. The extract also reduced significantly the charcoal induced Gastro Intestinal (GI) motility in mice; decreased the movement of GI tract in comparison to control animals. This study has found a base stone to step ahead for further researches to make them pharmaceutically useful.

Dillenia indica Linn. (commonly called elephant apple) for its pharmacognostic and pharmacological activities although, it is widely used as food and for medicinal purposes (Abdille *et al*., 2005; Kumar *et al*., 2009; Shome *et al*., 1979, 1980).From the fruits of this plant with potential anti-leukemic activities (Kumar *et al*., 2009). Banerji *et al.* (1975) pentacyclic triterpinoids were isolated. Two another new compounds dihydro-isorhamnetin and dillenetin have also been isolated by Haque *et al*. (2008). The leaves were extracted with ethanol and the phytochemical properties of *Dillenia indica* Linn.leaves were explored. A number of chemical investigations have been performed on this plant, as for example, Parvin *et al*. (2009) reported four new compounds from Dillenia indica; i.e., lupeol, betulinalhyde, betulinic acid and stigmasterol. Anti-inflammatory activity was found by the carrageenan-induced edema and acetic acid induced capillary permeability method by Yeshwante *et al*. (2009). Antinociceptive activity of the extracts was discovered by the acetic acid induced writhing method (Koster *et al*., 1959). An important application of *Dillenia indica* Linn. in traditional medicine is its antidiarrhoeal activity. Liquid extract of the leaves are still used as herbal medication for diarrhea.

Antinociceptive activity was explored with two different concentrations of 250 and 500 mg kg^{-1} b.wt. Antinociceptive activity of *Dillenia indica* was tested by acetic acid induced writhing model in mice. Acetic acid-induced writhing model causing pain sensation by triggering localized inflammatory response. Acetic acid, which is used to induce writhing, causes analgesia by liberation of endogeneous substances, which in turn excite the pain nerve endings (Taesotikul *et al*., 2003). Increased levels of PGE_2 and $PGF_{2\alpha}$ in the peritoneal fluid have been reported to be responsible for pain production caused by intraperitoneal administration of acetic acid (Derardt *et al*.,1980). The methanol extract of *Dillenia indica* showed significant writhing inhibition in comparison to the standard drug diclofenac sodium. According to the basis of this result it can be concluded that the extract possesses antinociceptive activity.

Antidiarrhoeal activity of the extract of *Dillenia indica* was tested by using the model of castor oil-induced diarrhoea in mice (Chatterjee, 1993). Castor oil mixes with bile and pancreatic enzymes and liberates ricinoleic acid from the triglycerides upon oral administration. Most of the ricinolic acid remains in the intestine and produces its absorptive or secretory effect. The ricinolic acid thus liberated readily forms of ricinoleate salts with sodium and potassium in the lumen of the intestine. The salt formed as such behaves like a soap or surfactant within the gut and at the mucosal surface. Generally ricinoleate salts stimulates the intestinal epithelial cells adenyl cyclase (Racusen and Binder, 1979) or released prostaglandin (Beubler and Juan, 1979). The extract caused and increased in latent period and decreased the frequency of defecation as well as the number of total stool count. Obtained the results of castor oil-induced diarrhoea, it can be concluded that the extract contains antidiarrhoeal activity.

Antidiarrhoeal results increased the interest to further check the motility of GI track. The results explain the antidiarrhoeal action of the extract. In normal diarrhoeal condition GI motility will be less. Charcoal meal, which was used to determine GI motility, moved 14.75 and 11.1 mm, respectively with the control mice and sample treated models. This influence on the GI motility is highly credential towards the antidiarrhoeal activity of the leaf extract In conclusion, it could be suggested that the methanol extract of *Dillenia indica* possesses antinociceptive and antidiarrhoeal activities. These facts indicate the scientific basis of *Dillenia indica* Linn. being used as a traditional medicine. However, further experiments may help to determine the pharmaceutical potentialities of the plant as a medicine.

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The anti-inflammatory activities of the methanol extract of *Dillenia indica* Linnaeus (Family Dilleniaceae) leaves were observed in various experimental models related to inflammation to provide some evidence for its traditional use. Anti-inflammatory activity was observed in carrageenan-induced edema and acetic acid-induced capillary permeability. The methanol extract showed significant (P <0.01) anti-inflammatory activity in the paw edema test and acetic acid-induced capillary permeability at 200 mg/kg and 400 mg/kg. The extract at 100 mg/kg showed significant (P <0.05) activity in acid-induced permeability. These findings support the folkloric use of Dillenia indica in diseases related to inflammatory conditions.

Dillenia indica L. is a common evergreen tree that grows widely in tropical forests in the western peninsula, Bihar, Sub Himalayan tracts, Assam, Bengal, and central and southern India from Sylhet to Sri Lanka. It has been grown in gardens for its handsome foliage and attractive flower as an ornamental plant. The plant is locally known as Karambel or Karmal in Marathi, Chalta in Hindi, and Ramphal in Nepal. [1],[2] The leaves, bark, and fruit of the plant are used in the indigenous system of medicine. It relieves abdominal pain and regulates the heat in the body. The fruit juice is mixed with sugar and water and used as a cooling beverage in the treatment of fever. It also tones up the nervous system and removes fatigue. The fruit juice is used as a cardiotonic. [3] The leaves and bark are used as a laxative and astringent. Bruised bark is applied as a cataplasm for patients with arthritis. [4] Phytochemical studies showed the presence of the lupeol group of triperpene such as betulinic acid and betulin and flavonol such as myricetin. Flavonoids such as Kaempferol, Quercetin, Isorhamnetin, Naringenin, and phenolic materials are also present. [5],[6] Pharmacological activity was evaluated and showed antioxidant activity in the fruit. [7] The alcoholic extract of the *Dillenia indica* leaves is reported to possess central nervous system (CNS) depressant activity. [8] As mentioned above, almost all traditional uses of the plant are concerned with anti-inflammatory (arthritis, cough, fever) activity. In order to prove the traditional utilization of *Dillenia indica* , this paper was intended to investigate the effect of *Dillenia indica* methanolic extract on inflammation using different animal models.

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8. DIOSCOREA BULBIFERA

Kingdom: Plantae

Order: Dioscoreales

Family: Dioscoreaceae

Genus: Dioscorea

Species: D. bulbifera

Binomial name

Dioscorea bulbifera

Dioscorea bulbifera (the **air potato**) is a yam species. It is also known as **Varahi** in Sanskrit, **Me kaachil** in Malayalam and **Dukkar Kand** in Marathi. It is a perennial vine with broad leaves and two types of storage organs. The plant forms bulbils in the leaf axils of the twining stems, and tubers beneath the ground. These tubers are like small, oblong potatoes, and they are edible and cultivated as a food crop, especially in West Africa. The tubers often have a bitter taste, which can be removed by boiling. They can then be prepared in the same way as other yams, potatoes, and sweet potatoes. The air potato is one of the most widely-consumed yam species.

Chemical constituents: Uncultivated forms, such as those found growing wild in Florida can be poisonous. These varieties contain the steroid, diosgenin, which is a principal material used in the manufacture of a number of synthetic steroidal hormones, such as those used in hormonal contraception.[1] There have been claims[2] that even the wild forms are rendered edible after drying and boiling, leading to confusion over actual toxicity. Air potato has been used as a folk remedy to treat conjunctivitis, diarrhea and dysentery, among other ailments.[3]

The air potato plant is native to Africa and Asia.[4] In some places, such as Florida, it is an invasive species because of its quick-growing, large-leafed vine that spreads tenaciously and shades out any plants growing beneath it. The bulbils on the vines sprout and become new vines, twisting around each other to form a thick mat. If the plant is cut to the ground, the tubers can survive for extended periods and send up new shoots later.

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DIOSCOREA BULBIFERA

Anticancer effects of various fractions extracted from Dioscorea bulbifera on mice bearing HepA

[Article in Chinese]

Yu ZL, Liu XR, McCulloch M, Gao J.

Zhongguo Zhong Yao Za Zhi. 2004 Jun;29(6):563-7.

To investigate the anti-cancer activities and the possible mechanism of Chinese herb Dioscrea bulbifera the following experiment was conducted.

The herb was extracted sequentially with petroleum ether, ethanol and water. The anticancer screen were carried out in vivo with HepA in mice.

The inhibitory effects on the formation of ascites volume and HepA cell viability in ascites were found in those extracted fractions except water fraction, the petroleum ether fraction being the strongest. Life span of mice bearing HepA ascites was prolonged after exposed to 100 mg x kg(-1) petroleum ether fraction and shortened after exposed to water fraction significantly. Besides, abnormal microstructure on HepA cells surface was found and it was supposed to be potential effect against viability of HepA which was convinced with the regeneration of HepA cells from ascites in mice exposed to petroleum ether fraction.

Anticancer active compounds are mainly extracted by petroleum ether from hydrophobic constituents of Dioscrea bulbifera and the anticancer effects were related to direct toxicity on tumor cell.

Antinociceptive activities of the methanol extract of the bulbs of Dioscorea bulbifera L. var sativa in mice is dependent of NO-cGMP-ATP-sensitive-K(+) channel activation.

Nguelefack TB, Dutra RC, Paszcuk AF, Andrade EL, Tapondjou LA, Calixto JB.

J Ethnopharmacol. 2010 Apr 21;128(3):567-74. Epub 2010 Feb 10.

Ethanopharmacological relevance using methanolic extract of Dioscorea bulbifera var sativa.

It is a medicinal plant commonly used in Cameroonian traditional medicine to treat pain and inflammation.The present work evaluated the effects of the methanol extract of the bulbs of Dioscorea bulbifera in inflammatory and neuropathic models of pain and further investigated its possible mechanism of action.

The effects of Dioscorea bulbifera administered orally at the doses of 250 and 500mg/kg were tested in mechanical hypernociception induced by intraplantar (i.pl.) injection of complete Freund's adjuvant (CFA), lipopolysaccharides (LPS) or prostaglandin-E(2) (PGE(2)), as well as in partial ligation sciatic nerve (PLSN), nociception induced by capsaicin and thermal hyperalgesia induced by i.pl. injection of CFA. The therapeutic effects of Dioscorea bulbifera on PGE(2)-induced hyperalgesia were evaluated in the absence and in the presence of l-NAME, an inhibitor of nitric oxide synthase (NOS) and glibenclamide, an inhibitor of ATP-sensitive potassium channels.

The extract showed significant antinociceptive effects in persistent pain induced by CFA and on neuropathic pain induced by PLSN. The effects of Dioscorea bulbifera persisted for 5 days after two administrations in CFA-induced hypernociception. Dioscorea bulbifera significantly inhibited acute LPS-induced pain but failed to reduce thermal hypernociception and capsaicin-induced spontaneous nociception. The antinociceptive effects of this plant extract in PGE(2) model was antagonized by either l-NAME or glibenclamide. The present work demonstrate the antinociceptive activities of Dioscorea bulbifera both in inflammatory and neuropathic models of pain and these effects may result, at least partially, from its ability to activate the NO-cGMP-ATP-sensitive potassium channels pathway.

ANTIHYPERGLYCEMIC AND ANTIDYSLIPIDEMIC ACTIVITY OF AQUEOUS EXTRACT OF *DIOSCOREA BULBIFERA* TUBERS

Zabeer Ahmed, Mohd Zahoor Chishti, Rakesh Kamal Johri, Asha Bhagat, Kuldeep Kumar Gupta, Gandhi Ram

Diabetologia Croatica 38-3, 2009

Dioscorea bulbifera, the ‘air potato’, has been used in the Chinese system of medicine to treat diseases of the lungs, kidneys and spleen, and many types of diarrhea. Commonly known as yams, these plants have been traditionally used to lower glycemic index, thus providing a more sustained form of energy and

better protection against obesity and diabetes. The present study was carried out to scientifically evaluate the aqueous extract of Dioscorea bulbifera tubers (DBEA003) for its antihyperglycemic activity in glucose primed and streptozotocin (STZ) treated Wistar rats and antidyslipidemic potential in high fat diet fed C57BL/6J mice, respectively. The antihyperglycemic effect was evaluated in temporarily established hyperglycemic condition by priming Wistar rats with 1.5 g/kg p.o. glucose and rendering them diabetic by the injection of STZ (45 mg/kg, intraperitoneally). Dyslipidemic condition was induced in C57BL/6J mice by feeding them high fat diet. DBEA003 at 250, 500 and 1000 mg/kg doses administered for 3 weeks to STZ treated rats and for 4 weeks to high fat diet fed C57BL/6J mice showed significant antihyperglycemic and antidyslipidemic effects. In STZ treated rats with severe diabetes, the 7- week DBEA003 treatment produced significant reduction in blood glucose level and increase in body weight. Serum glucose and lipid levels were reversed towards normal in DBEA003 treated high fat diet fed mice. This work supports the claims of previous research workers based on methods cited in this paper(1-14). **The list of chemical constituents are shown in the article given by G.R. Sajitha as an additional information at the end of this section**. See page 131

The current piece of work reports on the study of herbal extracts in diabetes and related markers. *Dioscorea bulbifera* is native to Africa and Asia and is commonly known as ‘air potato’. The tubers often have a bitter taste, which can be removed by boiling. They can then be prepared in the same way as other yams, potatoes, and sweet potatoes. The air potato is one of the most widely-consumed yam species (15). Several species, known as yams, are important agricultural crops in tropical regions, grown for their large tubers. Many of these are toxic when fresh, but can be detoxified and eaten, and are particularly important in some parts of Africa, Asia, and Oceania (16). *Dioscorea bulbifera* has been widely used in the Chinese system of medicine as a valuable herb in the process of rebuilding and maintaining kidney function. This herb was also found to have a beneficial effect in treating diseases of the lungs and spleen, and many types of diarrhea, improving digestion and metabolism. In Asia, this herb has been highly recommended for treating diabetes disorder. It has been traditionally used to lower glycemic index, providing a more sustained form of energy and better protection against obesity and diabetes; however, this property has not yet been scientifically proven (17). Some scanty reports are available on *Dioscorea bulbifera* use in diabetes mellitus and other related disorders, but no scientifically validated study has been carried out to justify its potential in experimental diabetes and dyslipidemia. In the present study these workers investigated the aqueous extract of *Dioscoreabulbifera*, DBEA003, for its antihyperglycemic effect in glucose primed and streptozotocin (STZ) treated Wistar rats, and antidyslipidemic effect in high fat diet (HFD) fed C57BL/6J mice.The results showed positive effects as expected.

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9. DIOSPYROS

Diospyros is a genus of about 450-500 species of deciduous and evergreen trees. The majority are native to the tropics, with only a few species extending into temperate regions. They are commonly known as ebony or persimmon **trees (1)**. The generic name is derived from the Greek words *διός* (*dios*), meaning "of Zeus" and *πυρός* (*pyros*), meaning "grain"[2] and was originally applied to the Caucasian Persimmon (*D. lotus*).

Kingdom: Plantae

Order: Ericales

Family: Ebenaceae

Genus: Diospyros

Ecology

Diospyros species are important and conspicuous trees in many of their native ecosystems, such as lowland dry forests of the former Maui Nui in Hawaii,[3] Caspian Hyrcanian mixed forests, Kathiarbar-Gir dry deciduous forests, Louisiade Archipelago rain forests, Madagascar lowland forests, Narmada Valley dry deciduous forests, New Guinea mangroves or South Western Ghats montane rain forests. The fruit are rich in tannins and thus avoided by most herbivores when unripe; when ripe they are eagerly eaten by many animals however, such as the rare Aders' Duiker (*Cephalophus adersi*).

The foliage is used as food by the larvae of numerous Lepidoptera species:

Chemically important compound

The medically important Betulinic acid can be isolated from Diospyros leucomelas. Mode of action of this compound is given at the end of this section.

Uses by humans

The genus includes several plants of commercial importance, either for their edible fruit (persimmons) or for their timber (ebony). The latter are divided into two groups in trade: the pure black ebony (notably from D. ebenum, but also several other species), and the striped ebony or Calamander wood (from D. celebica, D. mun and others). Most species in the genus produce little to none of this black ebony-type wood; their hard timber (e.g. of American Persimmon, *D. virginiana*) may still be used on a more limited basis.

Coromandel Ebony (*D. melanoxylon*) leaves are used to wrap beedi

Leaves of the Coromandel Ebony (*D. melanoxylon*) are used to roll South Asian beedi cigarettes. Several species are used in herbalism, and D. leucomelas yields the versatile medical compound betulinic acid. Though bees do not play a key role as pollinators, in plantations *Diospyros* may be of some use as honey plant. D. mollis, locally known as mặc nưa, is used in Vietnam to dye the famous black lãnh Mỹ A silk of Tân Châu district.

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1. Antioxidant and antiproliferative activity of Diospyros lotus L. extract and isolated compounds.

Loizzo MR, Said A, Tundis R, Hawas UW, Rashed K, Menichini F, Frega NG, Menichini F.

Plant Foods Hum Nutr. 2009 Dec;64(4):264-70.

Chemical constituents and their actions

The object of the study was to determine the chemical composition of Diospyros lotus L. extract and their antioxidant and antiproliferative properties. Eight compounds were isolated from D. lotus and identified as gallic acid, methylgallate, ellagic acid, kaempferol, quercetin,myricetin, myricetin 3-O-beta-glucuronide, and myricetin-3-O-alpha-rhamnoside. D. lotus extract tested in different in vitro systems (DPPH, ABTS, FRAP, and Fe2+ chelating activity assay) showed significant antioxidant activity. The potential antiproliferative properties of D. lotus extract and isolated compounds against nine human cancer cell lines such as COR-L23, CaCo-2, C32, ACHN, A375, A549, Huh-7D12, MCF-7, and LNCaP were investigated in vitro by SRB assay. D. lotus extract demonstrated the highest inhibitory activity against COR-L23 with an IC50 value of 12.2 microg/ml. Among identified hydrolysable tannins, ellagic acid evidenced strong antiproliferative activity against both C32 and A375 cells with IC50 values of 0.8 and 4.1 microg/ml, respectively. Interesting results were observed, also, with gallic acid that showed the highest cytotoxic activity against CaCo-2 (IC(50) 2.6 microg/ml). Overall, the results of this study suggest that D. lotus displays a good antioxidant activity and has antiproliferative effects. Both activities are related to identified phenolic compounds.

2. Pharmacology and chemotaxonomy of Diospyros.

Mallavadhani UV, Panda AK, Rao YR.

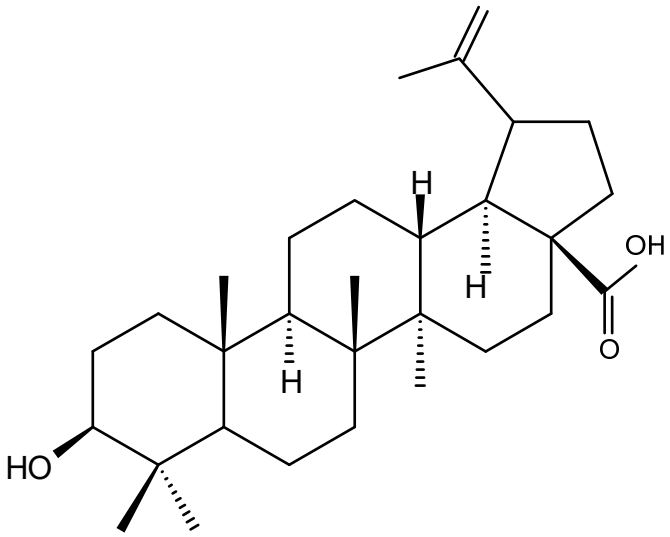
Phytochemistry. 1998 Oct;49(4):901-51.

Chemical constituents and their actions

Diospyros is numerically and economically the most important genus of Ebenaceae. The medicinal uses and chemical constituents of various Diospyros species are now reviewed. About 300 organic chemicals have been isolated and identified. The uniqueness of the genus is the elaboration of a large number of pentacyclic triterpenes and juglone based 1,4-naphthoquinone metabolites. These metabolites can be used as chemical markers for taxonomic studies. A common biogenetic pathway for their co-occurrence is now proposed. Various compounds are tabulated according to their classes and their structures are given in the Appendix.

Betulinic acid and their Mode of action

Betulinic acid is a naturally occurring pentacyclic triterpenoid which has anti-retroviral, anti-malarial, and anti-inflammatory properties, as well as a more recently discovered potential as an anticancer agent, by inhibition of topoisomerase.[1] It is found in the bark of several species of plants, principally the white birch (*Betula pubescens*)[2] from which it gets its name, but also the Ber tree (*Ziziphus mauritiana*), selfheal (Prunella vulgaris), the tropical carnivorous plants *Triphyophyllum peltatum* and *Ancistrocladus heyneanus*, *Diospyros leucomelas* a member of the persimmon family, *Tetracera boiviniana*, the jambul (*Syzygium formosanum*),[3] flowering quince (*Chaenomeles sinensis*),[4] Rosemary,[5] and *Pulsatilla chinensis*.[6]



Anti-tumor activity

In 1995, betulinic acid was reported as a selective inhibitor of human melanoma.[7] Then it was demonstrated, that betulinic acid induces apoptosis in human melanoma in vitro and in vivo model systems.[8] Currently it is undergoing development with assistance from the Rapid Access to Intervention Development program of the National Cancer Institute.[2] Also betulinic acid was found active against neuroectodermal (neuroblastoma, medulloblastoma, Ewing's sarcoma[9]) and malignant brain tumors,[3][10] ovarian carcinoma,[3] in human leukemia HL-60 cells,[6] malignant head and neck squamous cell carcinoma SCC25 and SCC9 cell lines.[11] In contrast, epithelial tumors, such as breast carcinoma, colon carcinoma, small cell lung carcinoma and renal cell carcinoma as well as T-cell leukemia cells were completely refractory to treatment with betulinic acid.[9]

Mode of action

Regarding the mode of action of betulinic acid, little is known about its antiproliferative and apoptosis-inducing mechanisms. In neuroectodermal tumor cells betulinic acid–induced apoptosis is accompanied by caspase activation, mitochondrial membrane alterations and DNA fragmentation.[9][11] Caspases are produced as inactive proenzymes, which are proteolytically processed to their active forms. These proteases can cooperate in proteolytic cascades, in which caspases activate themselves and each other. The initiation of the caspases cascade may lead to the activation of endonucleases like caspase-activated DNAase (CAD). After activation CAD contributes to DNA degradation.[11] Betulinic acid induces apoptosis by direct effects on mitochondria, leading to cytochrome-c release, which in turn regulates the "downstream" caspase activation.[11] Betulinic acid bypasses resistance to CD95 and doxorubicin-mediated apoptosis, due to different molecular mechanism of betulinic acid-induced apoptosis.

Controversial is a role of p53 in betulinic acid-induced apoptosis. Fulda suggested p53-independent mechanism of the apoptosis, basing on fact of no accumulation of wild-type p53 detected upon treatment with the betulinic acid, whereas wild-type p53 protein strongly increased after treatment with

doxorubicin.[9] The suggestion is supported by study of Raisova.[12] On the other hand Rieber suggested that betulinic acid exerts its inhibitory effect on human metastatic melanoma partly by increasing p53.[13]

The study also demonstrated preferential apoptotic effect of betulinic acid on C8161 metastatic melanoma cells, with greater DNA fragmentation and growth arrest and earlier loss of viability than their non-metastatic C8161/neo 6.3 counterpart.[13] Comparing the betulinic acid with other treatment modes, Zuco demonstrated that it was more than 10 times less potent than doxorubicin (IC50 4.5 μg/ml Vs IC50 0.21-034 μg/ml in doxorubicin) [I think the original author has a missing decimal point in the expression 0.21-034 μg/ml. I think it should be 0.21-0.34 μg/ml. Could somebody check his references to find out if I am correct] and showed an *in vitro* antiproliferative activity against melanoma and non-melanoma cell lines, including those resistant to doxorubicin. On the human normal dermatoblast cell line betulinic acid was 2-5 times less toxic than doxorubicin.[3] The ability of betulinic acid to induce two different effects (cytotoxic and cytostatic) on two clones derived from the same human melanoma metastasis suggests that the development of clones resistant to this agent will be more unlikely, than that to conventional cytotoxic drugs. Moreover in spite of the lower potency compared with doxorubicin, betulinic acid seems to be selective for tumor cells with minimal toxicity against normal cells.[3] The effect of betulinic acid on melanoma cell lines is stronger than its growth-inhibitory effect on primary melanocytes.[14] Study of combination of betulinic acid with γ-irradiation showed clearly additive effects, and indicates that they differ in their mode of action.[14]

Anticancer derivatives

A major inconvenience for the future clinical development of betulinic acid and analogues resides in their poor solubility in aqueous media like blood serum and polar solvents used for bioassays. To circumvent this problem of hydrosolubility and to enhance pharmacological properties, many derivatives were synthesized and evaluated for cytotoxic activity. A study showed that C-20 modifications involve the loss of cytotoxicity. Another study demonstrated the importance of the presence of the COOH group since compounds substituted at this position like lupeol and methyl betulinate were less active on human melanoma than betulinic acid. Moreover, some C-28 amino acids and C-3 phthalates derivatives exhibited higher cytotoxic activity against cancer cell lines with improved selective toxicity and water solubility. Chatterjee and co-workers obtained the 28-O-β-D-glucopyranoside of betulinic acid by microbial transformation with Cunninghamella species while Baglin and co-workers obtained it by organic synthesis. This glucoside did not exhibit any significant in vitro activity on human melanoma (MEL-2) and human colorectal adenocarcinoma (HT-29) cell lines which confirms the importance of the carboxylic acid function to preserve the cytotoxicity. Recently, Gauthier and coworkers have synthesized a series of 3-*O*-glycosides of betulinic acid which exhibited a strongly potent *in vitro* anticancer activity against human cancer cell lines.[15]

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10. DRACOCEPHALUM

Dracocephalum is a genus of about 45 species of flowering plants in the family Lamiaceae, native to temperate regions of the Northern Hemisphere. They are annual or perennial herbaceous plants or subshrubs, growing to 15-90 cm tall.

Kingdom: Plantae

Order: Lamiales

Family: Lamiaceae

Genus: Dracocephalum L.

Dracocephalum moldavicum

Dracocephalum moldavicum is also known as Moldavian Balm, Moldavian Dragon's Head, or simply the Dragonhead. It is an erect, bushy, branching plant found from eastern Europe to Siberia.

Chemical constituents of Dracocephalum forrestii.

Li SM, Yang XW, Li YL, Shen YH, Feng L, Wang YH, Zeng HW, Liu XH, Zhang CS, Long CL, Zhang WD.

Planta Med. 2009 Dec;75(15):1591-6

A systematic phytochemical examination of the whole plant Dracocephalum forrestii led to the isolation of 4 new and 65 known chemical constituents. By detailed 1D and 2D NMR spectroscopic analyses, the new compounds were identified as 4-hydroxy-3-methoxyphenylethanol 8- O-[(6- O-syringoyl)- beta- D-glucopyranoside] (1), 3,4,5-trimethoxyphenylethanol beta- D-glucopyranoside (2), 4-O-[beta- D-glucopyranosyl-(1 --> 3)- alpha- L-rhamnopyranosyl]phenylethylcinnamamide (3), and 9"-O- N-butyl lithospermate (4). The new isolates were evaluated for inhibitory activities against LPS-induced NO production in RAW 264.7 macrophages. Compound 2 revealed a moderate effect without any cytotoxicity under the assayed concentrations. Georg Thieme Verlag KG Stuttgart. New York

Chemical Composition and Antioxidative Activity of Moldavian Balm (*Dracocephalum moldavica* L.) Extracts

Keyvan Dastmalchi, H.J. Damien Dorman, Into Laakso-and Raimo Hiltunen

LWT - Food Science and Technology

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Moldavian balm (*Dracocephalum moldavica* L., Lamiaceae) is a perennial herb native to central Asia and naturalized in eastern and central Europe. It is commonly consumed as a food-related product and as a herbal preparation because of its reputed medicinal properties. Despite its importance, few reports exist in the literature regarding the chemistry or antioxidant activity of this species. In this study, the aerial material of Moldavian balm collected from Iran was extracted by Soxhlet using seven solvents of different polarity, viz., petroleum ether, dichloromethane, acetonitrile, ethyl acetate, methanol, *n*-butanol and water. The qualitative–quantitative chemical composition of each extract was determined using high-performance liquid chromatography coupled to photodiode array detection. For each extract, the total phenolic content was estimated as was the in vitro antioxidant activity using the iron(III) reduction assay, the *β*-carotene–linoleic acid bleaching assay and the 1,1-diphenyl-2-picrylhydrazyl and 2,2′-azinobis(3-ethylbenzothiazoline-6-sulphonate) free radical scavenging assays. Hydroxylated cinnamic acids, their derivatives and flavonoids were identified and quantified within the extracts, with rosmarinic acid being the most abundant component identified. The extracts demonstrated different degrees of potency within each assay, however, the observed pattern was not necessarily replicated between assays indicating the importance of the use of more than one screening technique to estimate the antioxidant activity of plant extracts.

NB: In Punjab during the spread of Covid-19 in 2021, some people consumed the fruits of Dragon head tree and the pandemic did not affect them. Further investigation is warranted. News paper reports (Dr. K.T. Augusti)

Effects of Total Extracts of Dracocephalum moldavica on Ischemia/Reperfusion Induced Arrhythmias and Infarct Size in the Isolated Rat Heart

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Iranian Journal of Basic Medical Sciences

Vol. 11, No. 4, Winter 2009, 229-235

Chemical constituents of D. moldavica and their pharmacological actions

Dracocephalum moldavica (D. moldavica) have been traditionally used as a cardiotonic agent in the folk medicine of some regions of Iran. Most of the previous studies have focused on analyzing and detecting the phytochemical compounds of D. moldavica. Dastmalchi et al (2007) reported the presence of polar compounds including hydroxycinnamic acids and flavonoids, with caffeic and ferulic acids, luteolin and apigenin in the total extract of D. moldavica (1). In another study, two important compounds (syringaresinol 4-Obeta- D-monoglucoside and beta-daucosterol) were identified in the extract (2). Some

compounds in the total extract demonstrated antioxidant activity (1,3) and daucosterol showed potent protective effects against cellular oxidative damages in comparison with lovastatin (2). The presence of apigenin in the extract decreased the platelet aggregation by reduction of cyclic AMP response to prostacyclin (4). In addition, syringaresinol 4-O-beta-D- monoglucoside produced calcium channel blocking activity (5) which may probably protect heart from stress damage(6). Despite the potential protective effects of some chemical compounds of D. moldavica (antioxidant activity, protection against oxidative damages and platelet aggregation, etc.), there is no report regarding cardioprotective effects of total extract of D. moldavica against ischemia/reperfusion injuries. Therefore, in the present study, the effects of total methanolic extract of D. moldavica on ischemia/reperfusion (I/R) induced cardiac arrhythmias and infarct size were investigated in the isolated rat heart.

Total extract of D. moldavica principally contains polar compounds including hydroxyl cinnamic acids and flavonoids, with caffeic and ferulic acids, luteolin-7-O-glucoside, rosmarinic acid, luteolin and apigenin (1). Other isolated chemical compounds of the plant are syringaresinol 4-O-beta-Dmonoglucoside, syringaresinol-4,4'-O-bisbeta- D-glucoside, 2"-p-coumarylastragalin, kaempferol – 3 – O – beta – D - (6"-O-p-coumaroyl)- galactopyranoside, takakin-8-O-beta-Dglucopyranoside and beta-daucosterol (2). Total extract of D. moldavica has demonstrated activity in all antioxidant assay methods (1, 6, 7,8). Some epidemiological reports have demonstrated that people may have lower incidence of heart diseases if they use a high dietary intake of flavonoids (9).The presence of flavonoids, antioxidants and compounds releasing nitric oxide (NO) from endothelium (10) in the extract may probably have important roles in preventing I/R induced injuries such as arrhythmia and infarction (11).

The isolated hearts were mounted on a Langendorff apparatus then perfused during 30 min regional ischemia and 120 min reperfusion, either by a modified Krebs-Henseleit solution as the control group or by enriched Krebs solution with total extract of D. moldavica (25-200 μg/ml) as the treatment groups. The ECGs recorded and analyzed to determine cardiac arrhythmias. At the end of the reperfusion, the hearts stained by Evans blue solution then incubated by triphenyltetrazolium chloride. The volume of infarcted tissue and percentage of infarct size were determined by computerized planimetry.

The results demonstrated that total extract of D. moldavica caused a significant reduction in the number of ventricular tachycardia (VT), total ventricular ectopic beats (VEBs) and VT duration in ischemic and reperfusion periods. The incidence of ischemic VT reduced from 93% in the control group to 0, 50 and 50% in the treatment groups. The infarct size was 37±1% in the control group, however, perfusion of the extract (25, 50, 200 μg/ml) reduced it to 13±2, 8±1 and 18±2%, respectively ($P<0.001$). In addition, the extract remarkably lowered volume of infarcted tissue compared to the control group ($P<0.05$).

Our findings showed cardioprotective effects of total extract of D. moldavica against ischemia/reperfusion injuries in the isolated rat heart.

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Additional Informations on 4 Medicinal Plants included above

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1. DESMODIUM GANGETICUM (Family: Fabaceae**)**

Hin: salpan, salvan

Kan: Nabiyalabune, Nariyalavona

Mal: Orila

San: Prsniparni, Prthakparni

Tam: orila

Tel: Gitanaram

Occurrence: Through out India

Plant parts used: Roots, aerialparts

Preparation of plant extract from: root

By Gino A Kurian, Srilalitha Suryanarayanan, Archana Raman and Jose Padikkala

Title: Antioxidant effects of ethyl acetate extract of Desmodium gangeticum root on myocardial ischemia reperfusion injury in rat hearts, Chin Med. 2010; 5: 3. Published online 2010 January 22. doi: 10.1186/1749-8546-5-3 (PMCID:PMC2831010)

Method for the preparation of plant extract: The roots were dried under shade and ground to a powder (100 g) which was extracted by ethyl acetate (60-80°C) in a Soxhlet apparatus for 72 hours. The extract was concentrated under vacuum and dried at room temperature and obtained brownish extract (8.8 g).

Preparation of plant extract from root and aerial parts are given by

A Niranjan and S. K. Tewari

Title: Phytochemical compositon and antioxidant potential of Desmodium gangeticum(Linn) DC., J. of Natural product radiance, vol.7(1), 2008, pp. 35-39

Method for the preparation of plant extract: Desmodium gangeticum roots and aerial parts were dried at 45^{O}C in an oven and powdered to pass through 100 mesh sieve. The root powder (1.5 Kg) was extracted overnight with ethanol (3 X 2.5L) at room temperature. The combined ethanol extract was concentrated under reduced pressure and the dark brown viscous residue (60g) thus obtained was suspended in water (500ml) and extracted sequentially with hexane (3X300ml) chloroform (3X 300ml)

and butanol (3x 300ml). The hexane fraction was concentrated under reduced pressure and the brownish residue (11g) thus obtained was subjected to column chromatography over silica gel (120g).

Phytochemical analysis: Showed the presence of Flavanoids, glycosides, pterocarpinoids, lipids, glycolipids and alkaloids.

Chemical constituents isolated: The sterols, N, N-dimethyltryptamine, their oxides and other derivatives were isolated from aerial parts of the plant; three pterocarpinoids, gangetin, gangetinin and desmodin, from the root (1)

Pharmacological action studied: Antiulcer activity, Antioxidant activity, Antiamnesic activity.

Mechanism of action studied:

Mechanism of antioxidant action: The effects of the extract might be due to the inhibition of lipid peroxidation (2).

Mechanism of action in ulcer: Ethanolic extract of Desmodium gangeticum increases mucin secretion (3).

Reference

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3. P. Dharmani, G. Palit , Exploring medicinal plants for anti ulcer activity Indian J Pharmacol ,April 2006: Vol 38, Issue 2; 95-9

2. DAUCUS CAROTA LINN. (family: Umbelliferae)

English: Carrot, Bees nest, Birds nest, Dauke

Hin: Gajar, Gajra

Kan: Gajjari

Mal: Karattu, Mannamullanki

San: Garjarah

Tam: Gajjarakkilangu, mancaimullanki

Tel: Gajjaragadda

Occurrence: Through out India

Plant parts used: roots, seeds

Prepartion of plant extract from: seeds

By Mani vasudevan, Kumar kishore Gunnam, and Milind parle

Title: Anti nociceptive and anti inflammatory properties of Daucus carota seeds extract, **J. of health science**, 2006 vol52 (5) 598-606

Method for the preparation of plant extract: Seeds were powdered in a hand grinder and defatted with petroleum ether (60-80^{O}C). The defatted seeds (2kg) were extracted with 95% ethanol using a soxhlet extractor at room temperature. After exhaustive extraction, the ethanolic extract was filtered and concentrated by distillation process. A brownish green coloured residue was obtained.

Phytochemical analysis: Presence of many chemical constituents including flavanoids and glycosides such as apigenin-4-o-β- glucoside and apigenin-7-o-β galacto pyranosyl β-D mannopyronoside (1) were shown.

Chemical constituents isolated from seed: The main chemical constituents of this carrot seed oil included a-pinene, camphene, b-pinene, sabinene, myrcene, y-terpinene, limonene, b-bisabolene, geranyl acetate and carotol.

Chemicals isolated from the tubers of carrot: ﷺ -sitosterol, Laserine and Epilaserine

Pharmacological action studied: Cardio protective activity, Antioxidant activity, Anti fungal activity, Anti nociceptive and Anti inflammatory activity

Mechanism of action studied:

Mechanism of cardio protective activity: Vacuum dried water extract of Daucus carota tubers exhibited decrease in the activity of Na^+K^+ATPase and $Mg2^+$ATPase and an increase in $Ca2^+$ATPase. This inhibition of Na^+K^+ATPase is similar to action of cardiac glycosides (2). Cardiac glycosides are specific and unique inhibitors of Na^+ K^+ATPase at normal concentrations. Na^+ K^+ATPase inhibition by cardiac glycosides leads ultimately to increase in intracellular $Ca2^+$concentration through $Na^+/Ca2^+$ exchanger and an associated increase in slow inward $Ca2^+$ currents as well as in transient $Ca2^+$ currents (3).

Mechanism of antifungal activity: The main constituent of carrot seed oil, carotol, which inhibited the radial growth of fungi (4).

Mechanism of antitumour activity: Epilaserine showed significantly inhibitory effect on leukemia cell

Reference

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3. DILLENIA INDICA L. (family: Dilleniaceae)

Common name: Elephant apple

Hin: Chalta

Occurrence: Through out India., Nepal, Bangladesh and Sri Lanka.

Plant parts used: Leaves, bark, and fruits

Preparation of plant extract from seed

By Himakar Reddy K etal

Title: Studies on hepatoprotective effect of hexane extract of Dillenia indica against CCl_4 induced toxicity and its safety evaluation in wistar albino rats

Research Journal of Pharmaceutical, Biological and Chemical Sciences, July – September 2010 RJPBCS Volume 1 Issue 3 Page No.441- 450

Method for the preparation of plant extract: Dillenia indica seeds were shade dried, powdered and subjected to solvent extraction. Hexane extract of Dillenia indica seeds were prepared by taking 100g

powder and soxhlated for 4 h with hexane and excess solvent was distilled off. The yield of the extract was 10.6% (v/w).

Preparation of plant extract from: fruits

By Kumar etal

Title: Anti-leukemic activity of Dillenia indica L. fruit extract and quantification of betulinic acid by HPLC. The Free Library, Date, 2010, May 1: **Phytomedicine**: International Journal of Phytotherapy & Phytopharmacology

Method for the preparation of plant extract: The fruits were cut into small pieces and air-dried at room temperature (25-28 ^{O}C). The dried fruits (calyx) of Dillenia indica (500g) were extracted with methanol for 72 h at room temperature. The whole extract was filtered and the solvent was evaporated under vacuum at 40-45 ^{O}C, the step executed three times, to afford 185 g crude (yield 37%) methanol extract. 150 g of methanolic extract was then suspended in water and partitioned successively with ethyl acetate and n-butanol. Each fraction was evaporated under vacuum to yield the residues of ethyl acetate 42 g (28%), n-butanol 38 g (25.33%) and aqueous 70g (46.67%) fractions respectively.

Preparation of plant extract from: leaves

By SB Yeshwante etal

Title: Anti-inflammatory activity of methanolic extracts of Dillenia indica L. leaves, J.of young pharmacists, Year : 2009 ,Volume : 1, Issue : 1, Page : 63-66

Method for the preparation of plant extract: Leaves were dried at room temperature under shade and powdered using a mixer grinder. The powder was continuously extracted using Soxhlet extractor with petroleum ether to remove oils, fats, and chlorophyll present. The powder was then extracted with methanol using Soxhlet extractor for 24 hrs at 40-50ºC. After complete extraction, methanolic extracts of Dillenia indica was concentrated under a vacuum to obtain a thick extract that was then dried in a hot air oven to get a free flowing powder. The yield of the extract was found to be 17% w/w.

Preparation of plant extract from stem

By Most. Nazma Parvin, Mohammad S. Rahman, Mohammad S. Islam and Mohammad A. Rashid

Title: Chemical and biological investigations of Dillenia indica Linn, Bangladesh J. Pharmacol 2009; 4: 122-125

Method for the preparation of plant extract and isolation: The air-dried and powdered plant material (1 kg) was extracted with methanol. The extractives were filtered through fresh cotton bed and finally with Whatman No. 1 filter paper. The filtrates were concentrated with a rotary evaporator at low temperature (40-50°C) and reduced pressure to provide crude methanol extract (7 g). The crude extract (5g) was partitioned with n-hexane, carbon tetrachloride, dichloromethane and chloroform, respectively. The subsequent evaporation of solvents afforded n-hexane (1.5 g), carbon tetrachloride (1.5 g), dichloromethane (0.6 g) and aqueous soluble (1.1 g) materials. The n-hexane soluble materials were fractionated by vacuum liquid chromatography. The column was eluted with petroleum ether, ethyl acetate and methanol mixtures of increasing polarities to provide 28 fractions (50 ml each). Compounds 1 (10 mg) and 2 (30 mg) were obtained as colorless crystals from the fraction eluted with 50% and 10% ethyl acetate in petroleum ether, respectively. The dichloromethane soluble materials of methanolic extract were fractionated by gel permeation chromatography over sephadex LH 20. The column was eluted with nhexane: dichloromethane:methanol (2:5:1) mixtures to provide 24 fractions (5 mL each). Compound 3 (10 mg) was found as amorphous powder from fractions 14-16. Evaporation of solvents from the vacuum liquid chromatographic fraction of n-hexane soluble materials eluted with 15% ethyl acetate in petroleum ether gave compound 4 (30 mg) as white mass

Phytochemical analysis: Showed the presence of the lupeol group of triterpene such as betulinic acid and betulin and flavonol such as myricetin. Flavonoids such as Kaempferol, Quercetin, Isorhamnetin, Naringenin and phenolic materials (1, 2). Showed presence of glycoside, steroids, flavonoids, saponins and reducing sugars from crude extract of the leaves

Chemical constituents isolated: Betulinic acid, betulin, cycloartenone, n-hentriacontanol and [beta]-sitosterol (3, 4).

Pharmacological action studied: Anti-leukemic activity, hepato protective activity, Anti-inflammatory activity, antioxidant activity and Antonociceptive activity

Mechanism of action studied with leaf extracts: Mechanism of Anti-inflammatory activity: anti-inflammatory activity and the possible mechanism might be inhibition of mediator release and PG biosynthesis (5).

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4. DIOSCOREA BULBIFERA (Family: Dioscoreaceae or yam family)

Common Names: Air potato, potato yam, air yam

Hindi: Zimikand

Malayalam: Mekachil

Synonymy: D. anthropophagum Chev., D. hoffa Cordemoy, D. sativa

Occurrence: in Southeast Asia.

Plant parts used: tubers

Preparation of aqueous extract from: Dioscorea bulbifera tubers

BY Zabeer Ahmed1, Mohd Zahoor Chishti2, Rakesh Kamal Johri1, Asha Bhagat, Kuldeep Kumar Gupta and Gandhi Ram

Title: Anti hyper glycemic and antidyslipidemic activity of aqueous extract of Dioscorea bulbifera tubers, **Diabetologia Croatica** 38-3, 2009 63-72

Method for the preparation of plant extract: The aqueous extract of Dioscorea bulbifera tubers was prepared by percolation with water. 0.5 kg of powdered material was successively percolated at ambient temperature for 4x16-hour times with 2 Lwater, then desolventized at 55±5 ºC under diminished pressure to obtain the aqueous extract.

Phytochemical analysis: Aqueous and methanol extracts of Dioscorea bulbifera showed the presence of flavonoids, furanoids and saponins.

Chemical constituents isolated: steroidal saponin, spiroconazole A, a phenanthrene, 2,7-dihydroxy-4-methoxyphenanthrene, flavonoids as quercetin, quercetin-3-O-A-D-glucopyranoside, and quercetin-3-O-A-D-galactopyranoside and seven clerodane diterpenoids namely bafoudiosbulbins A, B, C, D, E, F, were isolated from the methanol extract of the bulb of Dioscorea bulbifera var sativa (1,2,3,4)

Pharmacological action studied: Anti hyper glycemic activity, antislipidemic activity, anti tumour activity, analgesic activity and anti-inflammatory activity

Mechanism of anti tumour action: Ethanol extract of the rhizomes of Dioscorea bulbifera L. showed an inhibitory effect against the tumor promotion of JB6 (Cl 22 and Cl 41) cells induced by a promoter.

Mechanism of anti hyper glycemic and antidyslipidemic action: Dioscorea bulbifera L. extract might be reach target tissues in the body and act in glucose metabolism. Extracts resulted in activation of β-cells and granulation returned to normal, showing an insulinogenic effect. Another mechanism of action of extract for its antihyperglycemic effect might be due to the stimulation of insulin secretion from the remnant β-cells and/or regenerated β-cells (5).

Mechanism of analgesic activity and anti-inflammatory action: Dioscorea bulbifera extracts possesses peripheral analgesic activity and their mechanisms of action might be mediated through inhibition of local peritoneal receptors or arachidonic acid parthways, involving cyclo-oxygenases and/or lipoxygenases. Anti-nociceptive and anti inflammatory effects that may be mediated through inhibition of cell mediators such as histamine, serotonin, bradykinin and prostaglandins.

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