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Pharmacological Actions of *Cassia auriculata* L. and *Cissus quadrangularis* Wall.: A Short Review

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Abstract: Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources, many based on their use in traditional medicine. Therapeutically interesting and important drugs can be developed from plant sources which are used in traditional systems of medicines. Indian traditional system of medicine is based on empirical knowledge of the observations and the experience over millennia and more than 5000 plants are used by different ethnic communities in India. The present communication constitutes a review on the medicinal properties and pharmacological actions of *Cassia auriculata* L. and *Cissus quadrangularis* Wall. used in Indian traditional medicine. These plants are known to contain various active principles of therapeutic value and to possess biological activity against a number of diseases.

Key words: Medicinal plants, Pharmacology, Traditional medicine, *Cassia auriculata*, *Cissus quadrangularis*

INTRODUCTION

According to the WHO, 80% of the world's population primarily those of developing countries rely on plant-derived medicines for their health care needs (Gurib-Fakim, 2006). The use of medicinal plants as a source for relief from illnesses can be traced back over five millennia to written documents of the early civilizations in China, India and the Near East, but it is doubtless an art as old as mankind (Hamburger and Hostettmann, 1991). However, close to 25% of modern medicines are descended from plants that were first used traditionally (Northridge, 2002). Many plants throughout the world, including some with documented medicinal properties, contain chemicals that are toxic to microorganisms (Hudson, 1989). Folkloric uses are supported by a long history of human experience and numerous biologically active plants are discovered by evaluation of ethnopharmacological data and these plants may offer the local population immediately accessible therapeutic products (Perumalsamy *et al*., 2006).

Indian folk medicine comprises hundreds of herbal prescriptions for therapeutic purposes which may be as varied as healing wounds, treating inflammation due to infection, skin lesions, leprosy, diarrhoea, scabies, venereal diseases, snake bite and ulcers etc. The Indian flora is extensively utilized as source of many drugs mentioned in the traditional systems of medicine. During the last few decades there has been an increasing interest in the study of medicinal plants and their traditional use in different parts of India. Indian medicinal plants are widely used by all sections of the population and it has been estimated that over 7500 species of plants are used by several ethnic communities (Anthropological survey of India 1994). India possesses more than 500 tribal communities and even today, tribals and certain local communities in India practice herbal medicine to cure a variety

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of diseases and disorders (Mahishi *et al*., 2005). There are many reports on the use of plants in traditional healing by either tribal people or indigenous communities of India. The traditional systems of medicine together with folklore systems continue to serve a large portion of the population, particularly in rural areas, in spite of the advent of the modern medicines (Ayyanar and Ignacimuthu, 2005).

The focus of this review is to provide information on the medicinal properties, ethnomedicinal uses and pharmacological activities of *Cassia auriculata* and *Cissus quadrangularis* which are commonly used in Indian traditional medicine. These plants are known to contain various active principles of therapeutic value and to possess biological activity against a number of diseases (Kirtikar and Basu, 1935; Nadkarni, 1976). There is a number of pharmacological effects are reported on these plants. But no comprehensive account on these plants is available as a review yet. NCBI (Pubmed) and Medbioworld databases were used for the collection of pharmacological properties. As well as, ethnomedicinal information were extracted from the Dictionary of Indian Folk Medicine and Ethnobotany and some other publications which are published on the ethnobotanical aspects. The medicinal properties and plant characteristics were collected from the published books on Indian Medicinal Plants and Indian Materia Medica.

CASSIA AURICULATA L. (CAESALPINIACEAE)

It is an erect annual or biennial shrub found throughout India in open areas of forests. The leaves are bitter, astringent, acrid, thermogenic, haematinic, constipating and expectorant; seeds are also bitter, astringent, acrid, cooling, ophthalmic, diuretic, alexeteric and vulnerary (Nadkarni, 1976). The leaves are used for ulcer, leprosy and skin diseases; flowers are useful in diabetes and throat troubles and the fruit is useful in vomiting (Kirtikar and Basu, 1935). The leaf of this plant has been used in the traditional system of Indian medicine for the treatment of jaundice, liver diseases, leprosy and ulcers (Rajagopal *et al*., 2002; Rajagopal *et al*., 2003). The powdered dried flower bud is used as a substitute for tea in the case of diabetic patients and it is also supposed to improve the complexion in women and also considered to be one of the important dye yielding plants in India (Siva and Krishnamurthy, 2005).

Cassia auriculata has been widely used in Ayurvedic medicine as Avarai Panchaga Choornam and the main constituent of Kalpa herbal tea, has come under extensive study in the light of antidiabetic effects of this plant (Pari and Latha, 2002) (Fig. 1). In Sri Lanka, among herbal teas that are consumed most frequently the dried flowers of *Cassia auriculata* are considered to be beneficial for individuals suffering from diabetes mellitus, constipation and diseases of the urinary tract (Thabrew *et al*., 2004a).

Fig. 1: *Cassia auriculata*

The different parts of the plant is used by the tribal people in India for the treatment of body heat and cuts (Sandhya *et al*., 2006), asthma and cough (Singh and Pandey, 1980), dysentery (Malhotra and Moorthy, 1973), rheumatism and toothache (Sharma and Malhotra, 1984) and skin diseases (Parukutty and Sarma, 1987). Tribal people of Andhra Pradesh use this plant to treat asthma, skin diseases, conjunctives and renal disorders (Vedavathy *et al*., 1997).

Pharmacological Activities of *Cassia auriculata*

Leaf extract has a protective action against alcohol induced oxidative stress to the cells as evidenced by the lowered tissue lipid peroxidation and elevated levels of the enzymic and non-enzymic antioxidants (Rajagopal *et al*., 2003) and experimentally induced alcohol related liver damage (Rajagopal *et al*., 2002). The ethanol and methanol extracts of the flowers of *Cassia auriculata* showed antioxidant activity using improved assay based on the decolorization of the radical monocation of 2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging method (Kumaran and Karunakaran, 2007). Sabu and Subburaju (2002), showed that, in alloxan induced diabetic rats, chronic administration of the leaf extract significantly reduced the serum glucose level and the extract was found to inhibit the body weight reduction induced by alloxan administration. Pari and Latha (2002), studied the effects of flowers on blood glucose and lipid levels in experimental diabetic rats and the flowers possessed antihyperlipidaemic effect in addition to antidiabetic activity.

Methanol extract of flowers in Sprague-Dawley rats showed significant lowering of blood glycemic response toward maltose ingestion and concurrently suppressed insulin activity (Abesundara *et al*., 2004). Effect of aqueous extract of the flowers was examined on antioxidants and lipid peroxidation in the brain of streptozotocin diabetic rats (Latha and Pari, 2003a). They also showed the significant decrease in thiobarbituric reactive substances (TBARS) and hydroperoxide formation in brain suggesting its role in protection against lipid peroxidation induced membrane damage. The ethanol extract of the roots showed nephroprotective activity in cisplatin- and gentamicin-induced renal injury in male albino rats and it could be due to its antioxidant and free-radical-scavenging property (Annie *et al*., 2005). The presence of pyrrolizidine alkaloids in this plant produced liver lesions, disruption of the centrilobular veins, congestion or haemorrhage in the centrilobular sinusoids, centrilobular or focal hepatocellular necrosis and histopathology in the lungs and kidneys (Arseculeratne *et al*., 1981).

Thabrew *et al*. (2004a) revealed that, significant alterations in the steady state blood levels of carbamazepine can occur by concurrent ingestion of the prescribed drug with the herbal tea prepared from this plant and such alterations in steady state concentrations of the prescribed drug could result in loss of proper seizure control. Aqueous extract of the powdered whole plant material showed microbicidal property (Prakash, 2006) and methanol extract of the leaf and flowers of the plant showed significant antibacterial activity against *Bacillus* subtilis, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Enterococcus faecalis* and *Escherichia coli* (Duraipandiyan *et al*., 2006; Perumalsamy and Ignacimithu, 2000). The flower and leaf extract of the plant is reported to have antiviral, antispasmodic (Dhar *et al*., 1968) and antipyretic activity (Vedavathy and Rao, 1991).

Dianex is a polyherbal formulation prepared from the mixture of the aqueous extracts of this plant in combination with *Eugenia jambolana, Gymnema sylvestre*, *Momordica charantia*, *Azadirachta indica*, *Aegle marmelos*, *Withania somnifera* and *Curcuma longa*. It showed significant hypoglycemic activity in both normal and diabetic animals and it (Dianex) may be useful in the treatment of diabetes mellitus (Mutalik *et al*., 2005). Another polyherbal formulation hyponidd, prepared from the mixture of the extracts of this plant in combination with other nine plants such as, *Eugenia jambolana*, *Momordica charantia*, *Melia azedarach*, *Pterocarpus marsupium*, *Tinospora cordifolia*, *Gymnema sylvestre*, *Enicostemma littorale*, *Emblica officinalis* and *Curcuma longa* exhibited

antihyperglycaemic and antioxidant activity in STZ-induced diabetic rats (Babu and Prince, 2004). Diamed is also an herbal formulation composed of the aqueous extracts of this plant with two more medicinal plants such as, *Azadiachta indica* and *Momordica charantia* showed significant reduction in blood glucose, glycosylated haemoglobin and an increase in plasma insulin and total haemoglobin of rats with alloxan-induced experimental diabetes (Pari *et al*., 2001).

The effects of herbal tea prepared from the dried flowers of this plant enhanced the serum levels of theophylline by 32.5% were observed in Wistar rats (Thabrew *et al*., 2004b) and the concurrent ingestion of the herbal tea prepared from flowers with carbamazepine may therefore influence the bioavailability of the prescribed drug and hence its therapeutic potential. Effect of flower extract of the plant on hepatic glycolytic and gluconeogenic enzymes were studied in streptozotocin diabetic rats and the extracts significantly decreased blood glucose, glycosylated haemoglobin and gluconeogenic enzymes and increased plasma insulin, haemoglobin and hexokinase activity (Latha and Pari, 2003b) and they suggested that, the flower extract possessed an antihyperglycaemic effect and enhanced gluconeogenesis during diabetes is shifted towards normal and that the extract enhances the utilization of glucose through increased glycolysis.

CISSUS QUADRANGULARIS **WALL. (VITACEAE)**

It is perennial tendril climber with quadrangular stems found throughout the hotter parts of India. The plant is bitter, sweet, sour, thermogenic, alternative, laxative, anthelmintic, carminative, digestive, stomachic, depurative, haemostatic, aphrodisiac, anodyne and ophthalmic (Nadkarni, 1976). The stem is used for constipation, eye diseases, ulcers and broken bones; leaf and young shoots are useful in indigestion (Kirtikar and Basu, 1935). It is indigenous to Asia and Africa; used for many ailments, especially for the treatment of hemorrhoid (Panthong *et al*., 2006) (Fig. 2).

Cissus quadrangularis is widely used in ayurvedic medicine for its medicinal uses in gout, syphilis, venereal disease, piles, leucorrhoea and as an aphrodisiac and in the Siddha system of medicine for the treatment of piles, diarrhoea and dysentery (Shirwaikar *et al*., 2003). In India, traditionally the plant is widely used for the treatment of bone fractures (Singh and Maheswari, 1983; Shah *et al*., 1983; Goel and Mudgal, 1988), cuts and wounds (Gupta, 1981), dysenteryand indigestion (Shah *et al*., 1981), stomachache (Lakshamanan and Sankaranarayanan, 1988), swellings (Shah *et al*., 1983) and wounds (Goel and Mudgal, 1988) etc. The plant is also used as a common food supplement in southern India (Jainu *et al*., 2006c) and to treat cardiovascular diseases.

Pharmacological Activities of *Cissus quadrangularis*

This plant has outstanding useful in healing fractures (Udapa and Prasad, 1962; Udapa *et al*., 1963; Udapa and Prasad, 1964). Methanol extract of aerial parts of the plant have anti-inflammatory

Fig. 2: *Cissus quadrangularis*

activity and it could be produced by the flavonoids especially leuteotin and by β-sitosterol (Panthong *et al*., 2006). The aerial part of this plant possessed analgesic effect and was very effective in treating painful hemorrhoid. Shirwaikar *et al*. (2003), evaluated the ethanol extract of the plant for its anti-osteoporotic activity in ovariectomized rat model of osteoporosis at two different dose levels on the basis of biomechanical, biochemical and histopathological parameters and the study showed that the ethanol extract of the plant had a definite antiosteoporotic effect. Bah *et al*. (2006a), reported that this plant was used for the treatment of Schistosomiasis and have proteolytic property (Bah *et al*., 2006b). Mutagenetic (Sivaswamy *et al*., 1991) and genotoxic (Balachandran *et al*., 1991), activities have also reported for this plant. The plant is also vastly used in Malain traditional medicine for various purposes (Bah *et al*., 2006a; 2006b; 2007) and the extract of the plant showed antiplasmodial activity and $GABA_A$–benzodiazepine receptor binding activity. The extracts of the plant showed antibacterial and antioxidant properties (Chidambara Murthy *et al*., 2003).

Jainu *et al*. (2006a) illustrated that the extract of the plant has gastroprotective action against NSAID induced gastric ulcer and it is associated with the suppression of proinflammatory cytokines, scavenging action on free radicals and antiapoptotic effect by blocking DNA fragmentation during ulceration. They suggested that the therapeutic action of the plant extract against NSAID-induced gastric ulceration might be due to antioxidant, antiapoptotic and cytoprotective properties of the plant. The ethanol extract was used against gastric toxicity induced by aspirin in rats and the results revealed that administration of aspirin increased lipid peroxidation status, xanthine oxidase, myeloperoxidase and decrease in selenium-glutathione peroxidase activities in the gastric mucosa, resulting in mucosal damage at both cellular and subcellular level.

The gastroprotective activity of the extract could be mediated possibly through its antioxidant effect as well as by the attenuation of the oxidative mechanism and neutrophil infiltration (Jainu and Devi, 2006b) and proinflammatory cytokines (Jainu and Devi, 2005). The extract of the plant not only strengthens mucosal resistance against ulcerogens but also promotes healing by inducing cellular proliferation and it has potential usefulness for treatment of peptic ulcer disease (Jainu and Devi, 2004).

Formulations prepared from the plant produced statistically significant net reductions in weight and central obesity, as well as in fasting blood glucose, total cholesterol, LDL-cholesterol, triglycerides and C-reactive protein were observed in participants who received the formulation, regardless of diet (Oben *et al*., 2006). Extracts of this plant significantly prevented the gastric mucosal lesion development and decreased the gastric toxicity produced by ulcerogen (Jainu *et al*., 2006c) and these findings suggested that the extracts promoted ulcer protection by the decrease in ulcer index, gastric secretions and increase in the glycoprotein level, gastric mucin content and NPSH concentration and it may protect the gastric mucosa against ulceration by its antisecretory and cytoprotective property. The ethyl acetate extract and methanol extract of both fresh and dry stems exhibited antibacterial activity against Gram-positive bacteria, including *Bacillus subtilis*, *Bacillus cereus*, *Staphylococcus aureus* and *Streptococcus* spp. (Chidambara Murthy *et al*., 2003).

DISCUSSION

Historically, plants have provided a source of inspiration for novel drug compounds, as plant derived medicines have made large contributions to human health and well-being. Their role is two fold in the development of new drugs: first one is, they may become the base for the development of a medicine, a natural blueprint for the development of new drugs and the second one is a phytomedicine to be used for the treatment of disease (Iwu *et al*., 1999). There are numerous illustrations of plant derived drugs. Besides the use of purified and modified plant substances, there is the possibility of applying crude herbal preparations. There are a number of traditional plant preparations, which show

genuine pharmacological activities. The search for drugs active against tumors, viruses and cardiovascular and tropical diseases is a priority.

Many commercially proven drugs used in modern medicine were initially tried in crude form in traditional or folk healing practices, or for other purposes that suggested potentially useful biological activity. The primary benefits of using plant-derived medicines are that they are relatively safer than synthetic alternatives, offering profound therapeutic benefits and more affordable treatment (Iwu *et al*., 1999). About 25% of the drugs prescribed worldwide come from plants, 122 such active compounds being in current use (Fabricant and Farnsworth, 2001).

Fennell *et al*. (2004), suggested that various assays could be used to test for biological activity by in vitro and *in vivo*. Crude or fractionated extracts and sometimes individual compounds reported from the plants were screened for antibacterial, anti-inflammatory, antioxidant, anthelmintic, anti-amoebic, antischistosomal and antimalarial activity, as well as psychotropic and neurotropic properties. In testing for biological activity *in vitro*, a standard drug is always included in the test system to ensure that the assay is working effectively. The activity of an extract can then also be compared between different assays, although not with pure standards, as crude extracts contain a myriad of compounds that may be acting synergistically.

CONCLUSION

Thus, the review ascertains the value of plants used in tribal medicine, which could be of considerable interest in the development of new drugs. The curative properties of drugs are due to the presence of complex chemical substances of varied composition (present as secondary plant metabolites) in one or more parts of these plants. This review shows that, the different parts of the *Cassia auriculata* and *Cissus quadrangularis* exhibit various pharmacological activities on the basis of uses in traditional medicine. These plants are also proven to be very valuable to the discovery and utilization of medicinal natural products and potential for the development of leads, for example, antimicrobial and antidiabetic activity of *Cassia auriculata* and anti-rheumatic activity of *Cissus quadrangularis*. It is also clear that much needs to be discovered, both as to the active ingredients and their biological effects. The information summarized here is intended to serve as a reference tool to researchers in the fields of ethnopharmacology.

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