Research Journal of Medicinal Plant

ISSN 1819-3455

Academic Journals Inc.

www.academicjournals.com

Research Journal of Medicinal Plant 5 (4): 420-431, 2011
ISSN 1819-3455 / DOI: 10.3923/rjmp.2011.420.431

Bauhinia purpurea Linn.: A Review of its Ethnobotany, Phytochemical and Pharmacological Profile

[1]T. Kumar and [2]K.S. Chandrashekar
[1]Department of Pharmaceutical Chemistry, RCPSR, Bhilai, 491 024, C.G., India
[2]Department of Pharmacognosy, MIPS, Manipal, 457 6104, Karnataka, India

Corresponding Author: Tekeshwar Kumar, Department of Pharmaceutical Chemistry, RCPSR, Bhilai, 491 024, C.G., India Tel: +91 9827985722

ABSTRACT

The use of natural products as medicinal agents presumably predates the earliest recorded history. *Bauhinia purpurea* is a species of flowering plant is used in several traditional medicine systems to cure various diseases. This plant has been known to possess antibacterial, antidiabetic, analgesic, anti-inflammatory, anti-diarrheal, anticancerous, nephroprotective and thyroid hormone regulating activity. A wide range of chemical compounds including 5,6-Dihydroxy-7-methoxyflavone 6-*O*- β –D xylopyrano-Side, bis [3',4'-dihydroxy-6-methoxy-7,8-furano-5',6'-mono-methylalloxy]-5-C-5-biflavonyl and (4'-hydroxy-7-methyl 3-C-α-L-rhamnopyranosyl)-5-C-5-(4'-hydroxy-7- methyl-3-C-α-D-glucopyranosyl) bioflavonoid, bibenzyls, dibenzooxepins, mixture of phytol fatty esters, lutein, β-sitosterol, isoquercitin and astragalin etc. The present review discusses phyto-chemistry, pharmacology, medicinal properties and biological activity of *B. purpurea* and its usage in different ailments.

Key words: *Bauhinia purpurea,* pharmacology, phyto-chemistry

INTRODUCTION

Nature has provided a complete storehouse of remedies to cure ailment of mankind. Medicinal plants have been used for centuries as remedies for disease because they contain component of therapeutic values. According to the WHO, 80% of the world population continues to rely mainly on traditional medicines for their health care (WHO, 1993). Herbal medicines, as the major remedy in traditional medical systems, have been used in medical practice for thousands of years and have made a great contribution to maintaining human health. A majority of the world's population in developing countries still relies on herbal medicines to meet its health needs. The attention paid by health authorities to the use of herbal medicines has increased considerably, both because they are often the only medicine available in less developed areas and because they are becoming a popular alternative medicine in more developed areas (Gurib-Fakim, 2006). The continued investigation into the secondary plant metabolites has gained importance for their safe use.

GEOGRAPHICAL DISTRIBUTION

Bauhinia purpurea L. is a medium sized deciduous tree belongs to the family Leguminosae (Caesalpinioideae), native to South China (which includes Hong Kong) and Southeastern Asia and it is found throughout India, ascending to an altitude of 1300 m in the Himalayan (Khare, 2004).

B. purpurea is a moderate evergreen tree in sub-Himalayan region and western track of India and often its leaves are used as fodder during the lean period (Jha, 1995). The genus *Bauhinia*, consisting of 300 species (Chopra *et al*., 1996). In the United States of America, the tree grows in Hawaii, coastal California, southern Texas and southwest Florida. Common names include Hong Kong Orchid Tree, Purple camel's foot and Hawaiian orchid tree.

Plant profile: It is a small to medium-sized deciduous tree growing up to 17 m tall. The bark is ashy to dark brown, nearly smooth, young parts brown-pubescent. The leaves are 7.5-15 cm long, rather than longer than broad, cleft about half way down into 2 acute or rounded bilobed very minutely pubescent beneath when young, base usually cordarte, 9-11 nerved; petiole 2.25-3.8 cm long. The flowers are conspicuous, pink and fragrant with five petals. Pedicels 5-13 mm long, stout, tementose, bract and bracteoles small tementose, deltoid. Calyx tementose, tube 7.5-10 mm long, limb long as the tube. Petals 3.8 to 5 cm long, oblanceolate, long clawed, spreadind veined. Stamens usually 3 fertile, others reduced to antherless filaments. Ovary downy, long-stalked; style long; stigma large, oblique. Pod 15-25 by 1.5-2 cm on a tementose stipe 1.5 to 2.5 cm long, linear, flat, pointed, greenish, tinged with purple till ripe, late in dehiscing. Seeds 12-15 suborbicular, flattened, 1.3 cm. wide and dark brown smooth (Kritikar and Basu, 1991).

Indian names: In India it is known by its various vernacular names, the most commonly used ones are Orchid tree (English), Khairwal, Kaniar (Hindi), Sarul (Kannada), Chuvanna Mandaram (Malayalam), Vanaraja (Sanskrit), Mandari (Tamil), Bodanta (Telgu), Kaanchanaara, Kaanchana (*Ayurveda*): Sivappumanchori (Siddha).

Medicinal uses: The young pods and mature seeds of kachnar are known to be cooked and eaten by tribles such as the Kathkors and Gondas of India (Rajaram and Janardhanan, 1991). Species of Bauhinia are rich in polyphenolics and are known for its medicinal properties (Patil, 2003). *B. purpurea* known to the Malays as pokok tapak kerbau, has been traditionally used by the Indian, Sri Lankan and Pakistani people to treat ailment like ulcer, wound, glandular swelling and stomach tumor. The decoction of the root is used for expelling gases, flatulence and griping pain from the stomach and bowel, the bark of the plant is used as an astringent in the treatment of diarrhea. Its decoctions are recommended for ulcers as a useful wash solution. The bark or root and flower mixture with boiled rice water is used as maturant for boils and abscesses (Kurian, 2004). The decoction of flower works as a laxative (Wassel *et al*., 1986). Fresh bark of Kaanchanaara (*B. purpurea*) mixed with Shunthi (dry *Zingiber offficinale*), pounded with sour gruel, was prescribed in enlarge cervical glands (Vrindamaadhava) as well as in goiter (Shaarangadhara Samhitaa, Bhavaprakaasha). Over the counter Kaanchanaara (*B. purpurea*) Guggulu (Shaarangadhar Samhitaa) is used to treat enlarge cervical glands, goiter and scrofulous tumors, so is kaanchan-gudikaa (Bhaishjya Ratnaavali). It has also been reported to contain high phenolics which are usually referred to as anti-quality factor for ruminant nutrition's because of their high affinity with proteins (Yadav and Bhadoria, 2001). Although, there is no documentation on its traditional use to treat diseases among the Malaysians, this plant has been used in the Indian, Sri Lankan and Pakistani folklore medicine to treat ailments like glandular swellings, skin diseases, ulcers, diarrhea, stomach tumors and wounds (Jones and German, 1993). Several ethnomedicinal importance of *B. purpurea* is given in Table 1.

Table 1: Ethnomedicinal uses of different parts of *B. purpurea* Linn.

Plant part used	Ethnomedicinal uses
Whole plant	The whole plant is used in dropsy, pain, rheumatism, convulsions, delirium and septicemia (Asolker *et al*., 2000)
Flowers	Flower buds and flowers fried in ghee are reported to be given to patients suffering from dysentery (Kalakoti and Pangtey, 1988). Flower buds also used as laxative and anthelmentic (Shiddamallayya *et al*., 2010)
Root	Root bark is mixed with curd and used in hemorrhoids. Its paste with dried ginger applied internally in the treatment of goiter. The root is carminative (Chatterjee and Pakrashi, 1992) Infusion of small piece of root is used for the treatment of white spot on race ((Kamble *et al*., 2010)
Bark	The concentrated decoction of bark is used to treat lymph adenitis by tribal people of Jalgaon District (Pawar and Patil, 2007). The decoction of stem bark orally twice a day is very effective in asthma and other respiratory disorder as an anti-inflammatory agent (Patil *et al*., 2008). Also bark juice is useful in menstruation trouble and with honey is taken orally against leucorrhoea (Das *et al*., 2008)

PHYTOCHEMISTRY OF *B. PURPUREA*

B. purpurea contain major class of secondary metabolites are glycosides, flavonoids, saponins, triterpenoids, phenolic compounds, oxepins, fatty acids and phytosterols. From the ethanolic extract of the whole plant of *B. purpurea* two new oxepins named bauhiniastatins1 and 2 have been isolated and the ethanolic extract of root provides bauhiniastatins 1, 2, 3 and pacharin (Fig. 1) exhibit significant growth inhibition against a minipanel of human cancer cell lines (Pettit *et al*., 2006). The structures have been established on the basis of chemical evidence and spectroscopic methods. A novel flavone glycoside, 5,6-dihydroxy-7-methoxyflavone 6-*O*-b-D-xylopyranoside (Fig. 2) was isolated from the chloroform-soluble fraction of the ethanolic extract of *B. purpurea* stems (Yadav and Tripathi, 2000). Three glycerol derivatives and 6- butyl-3-hydroxyflavanone derivatives are 2, 3-dihydroxypropyl oleate, 2,3 dihroxypropyl linoleate, 2,3- dihydroxypropyl 16-hyroxy–decanoate and 6-butyl-3-hydroxyflavanone, 6-(3"-oxobutyl)-taxifolin (Fig. 3) respectively isolated from methanolic extract of heartwood of *B. purpurea* (Kuo *et al*., 1998). The two new dimeric flavonoids namely bis [3',4'-dihydroxy-6-methoxy-7,8-furano-5',6'-mono methylalloxy]-5-C-5-biflavonyl and (4'-hydroxy-7-methyl 3-C-α-L-rhamnopyranosyl)-5-C-5-(4'-hydroxy-7- methyl-3-C-α-D-glucopyranosyl) bioflavonoid (Fig. 4) with protein precipitating property obtained from 70% aq. acetone extract of *B. purpurea* leaves (Yadav and Bhadoria, 2005). The leaves of *B. purpurea* also afforded a mixture of phytol fatty esters, leutin and β-sitosterol (Fig. 5) (Ragasa *et al*., 2004). The petroleum ether fraction of ethanolic extract (95%) of *Bauhinia purpurea* leaf gave α- amyrin caprylate on successive column chromatography with petroleum ether (60-80°) and chloroform which gives Liebermann-Burchard test of triterpene. The compound is characterized by spectral analysis (Verma and Chandrashekar, 2009). In the flower volatile oils of both *B. purpurea* and *B. variegata* found monoterpenes (e.g., a-terpinene, limonene, myrcene, linalool, citronellyl acetate) and a phenylpropanoid (eugenol) (Wassel *et al*., 1986). The aqueous methanolic extract of fresh flower of *B. purpurea* gives flavonoid quercetin and flavonoid glycosides isoquercitin, astragalin (Fig. 6) (Ramchandra and Joshi, 1967) butein 4' O-β-L-arabinopyranosyl-O-β-D-galactoside (mp 265°) isolated from seed of *B. purpurea*. This gave the characteristic colour reactions of a chalcone and ion hydrolysis with 8% ethanolic H_2SO_4 for 12 h gave butein and a disaccharide, the component sugars which were found as galactose and

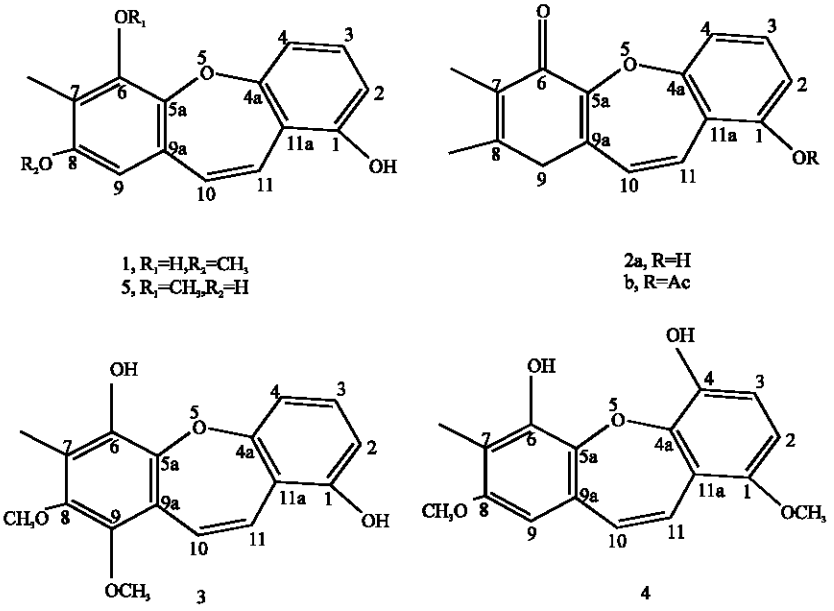

Fig. 1: Structure of oxepins

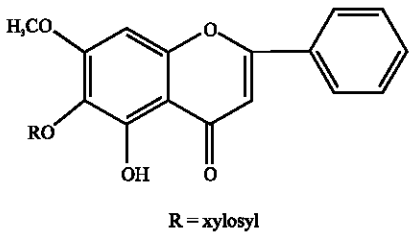

Fig. 2: Structure of flavone glycoside

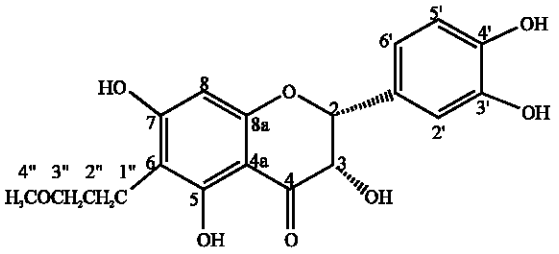

Fig. 3: Structure of 6-(3"-oxobutyl)-taxifolin

arabinose (Bharatiya *et al.*, 1979). A new glycoside 3,4-dihydroxychalcone 4-O-β-L-arabinopyranosyl-O-β-D-galactopyranoside (mp 365°) isolated from seed which gave the characteristic colour reactions of a chalcone and gave 3,4-dihydroxychalcone, galactose and arabinose on acid hydrolysis (8% ethanolic H_2SO_4 for 12 h). The identity of sugars was confirmed by co-chromatography with authentic samples and by the preparation of their osazones (Bharatiya and Gupta, 1981). After chalcone glycoside a novel flavone glycoside were isolated, Glycoside-6-4'-Diahydroxy-3'-prenyl-3,7,5,7'-Tetramethoxy Flavone-6-O-α-L-rhamnopyranoside

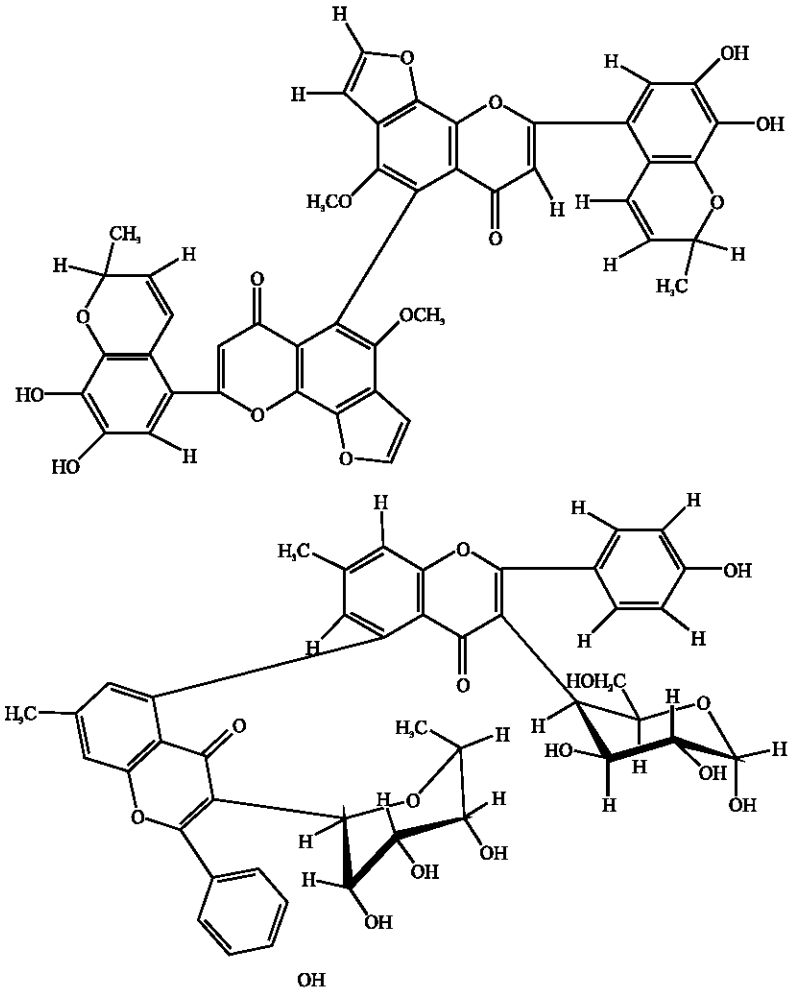

Fig. 4: Structure of dimeric flavonoids

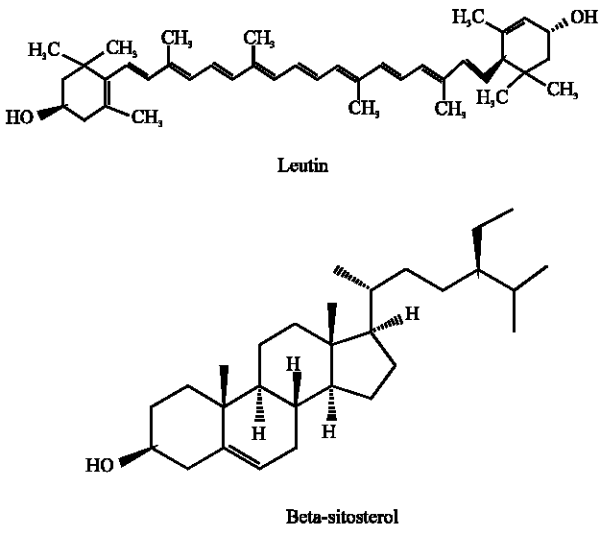

Fig. 5: Structure of leutin and beta-sitosterol

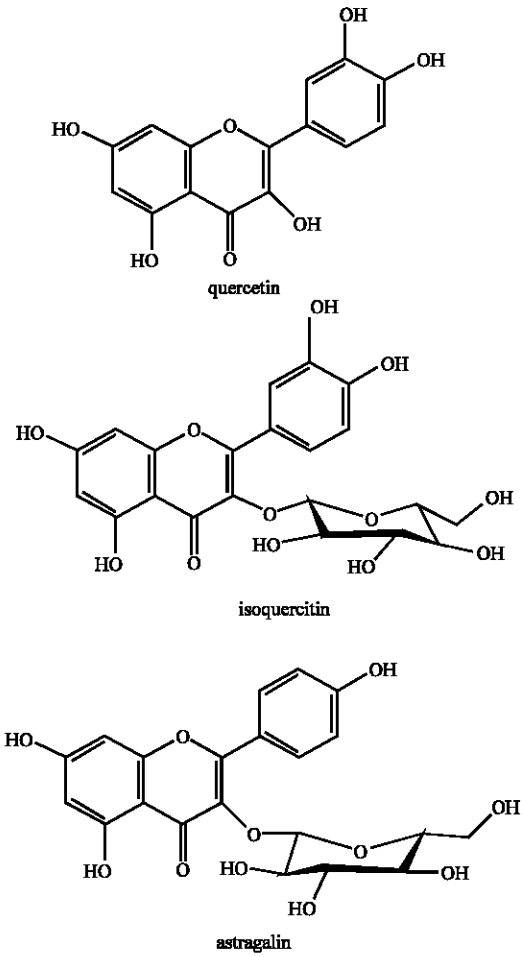

Fig. 6: Structure of flavonoids and flavonoid glycosides

(Fig. 7) from acetone soluble of ethanolic extract from seed of *B. purpurea* which gives positive test for Molisch and structure are confirmed by spectral data analysis (Yadav and Sodhi, 2001). The CH_2Cl_2 extract of root of *B. purpurea* on purification yield 11 new compounds bauhinoxepin C-J, bauhinobenzofurin A, bauhispirorin A, bauhinol E, two flavanones (-)-strobopinin and demethoxymatteucinol and five known bibenzyls (Fig. 8) which posses various pharmacological activities (Boophong *et al.*, 2007). All the compounds were characterized by spectral analysis. Kachnar (*B. purpurea)* seeds were found to contain about 17.5% crude seed oil. The amount of neutral lipids in the crude seed oil was the highest (99% of total lipids), followed by glycolipids and phospholipids, respectively. Linoleic, followed by palmitic, oleic and stearic, were the major fatty acids in the crude seed oil and its lipid classes. The ratio of unsaturated fatty acids to saturated fatty acid, was higher in neutral lipid classes than in the polar lipid fractions. The oil was characterized by a relatively high amount of phytosterols, wherein the sterol markers were β-sitosterol and stigmasterol. β-Tocopherol was the major tocopherol isomer with the rest being d-tocopherol (Ramadana *et al.*, 2006). *Bauhinia purpurea* seed is a source of galactose and lactose binding lectin, a peptide which interact with carbohydrate. The amino acid sequence of peptide that bind with lactose is Asp-Thr-Trp-Pro-Asp-Thr-Glu-Trp-Ser and is obtained of *Bauhinia purpurea* lectin by affinity chromatography of peptide with Asp-N endoproteinase or trysin on column

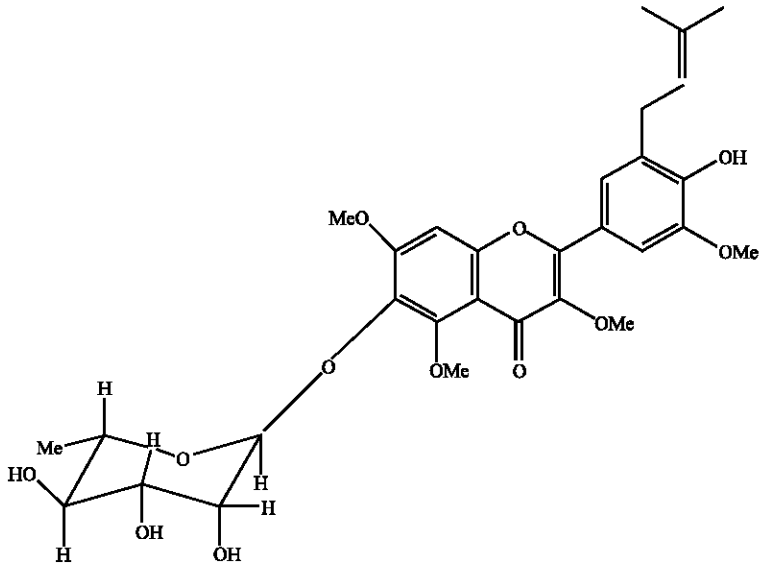

Fig. 7: Structure of novel flavone glycoside

of lactose-Sepharose 4B or lactose-, maltose-, fucose- and di-N-ucetylchitobiose-Sepharose and by solid phase synthesis. This peptide exhibits lactose binding activity in the presence of calcium (Yamamoto *et al*., 1991).

PHARMACOLOGICAL PROPERTIES OF *B. PURPUREA*

Antinociceptive, anti-inflammatory, analgesic and antipyretic properties: The aqueous extract of leaf of *B. purpurea possesses* good antinociceptive, anti-Inflammatory, analgesic and antipyretic. The crude dried extract was prepared in doses of 6.0, 30.0 and 60.0 mg kg^{-1} and subjected to the respective. They have used antinociceptive (abdominal constriction, hot plate and formalin tests), anti-inflammatory (carrageenan-induced paw edema test) and antipyretic (brewer's yeast-induced pyrexia test) assays. The 6.0 mg kg^{-1} AEBP exhibited the highest antinociceptive activity, the 30.0 mg kg^{-1} AEBP exhibited an equieffective anti-inflammatory activity when compared to the 100 mg kg^{-1} ASA only between the interval times of 1-4 h, The dose-independent antipyretic activity was observed only at the concentration 6.0 and 30.0 with the former showing remarkable activity even when compared with 100 mg kg^{-1} ASA (Zakaria *et al*., 2007). In Zakaria *et al*. (2009) established the antinociceptive and anti-inflammatory activities of chloroform extract of *B. purpurea* leaves using animal models. The different dose 20, 100, 200 mg kg^{-1} were prepared in dimethyl solfoxide were 100 mg kg^{-1} extract showed a less remarkable anti-inflammatory activity compared to the other doses tested. Analgesic and anti-inflammatory activities of ethanolic extract of stem of *B. purpurea* was subjected. Different CNS depressant paradigms like analgesic activity (Eddy's hot plate method and acetic acid writhing method) and anti-inflammatory activity (carrageenan induced paw edema) were carried out following the intra peritoneal administration of extract at dose level 50 and 100 mg kg^{-1}. Dose of 100 mg kg^{-1} was comparable with standard drugs (Shreedhara *et al*., 2009). The aqueous and methanolic extract of the stem bark of *Bauhinia purpurea* were tested for anti-inflammatory activity at dose level 300 mg kg^{-1} by carageenan induced rat paw edema. Both the extract were tested against standard drug diclofenac were ethanolic extract showed maximum activity, However the extracts activity is

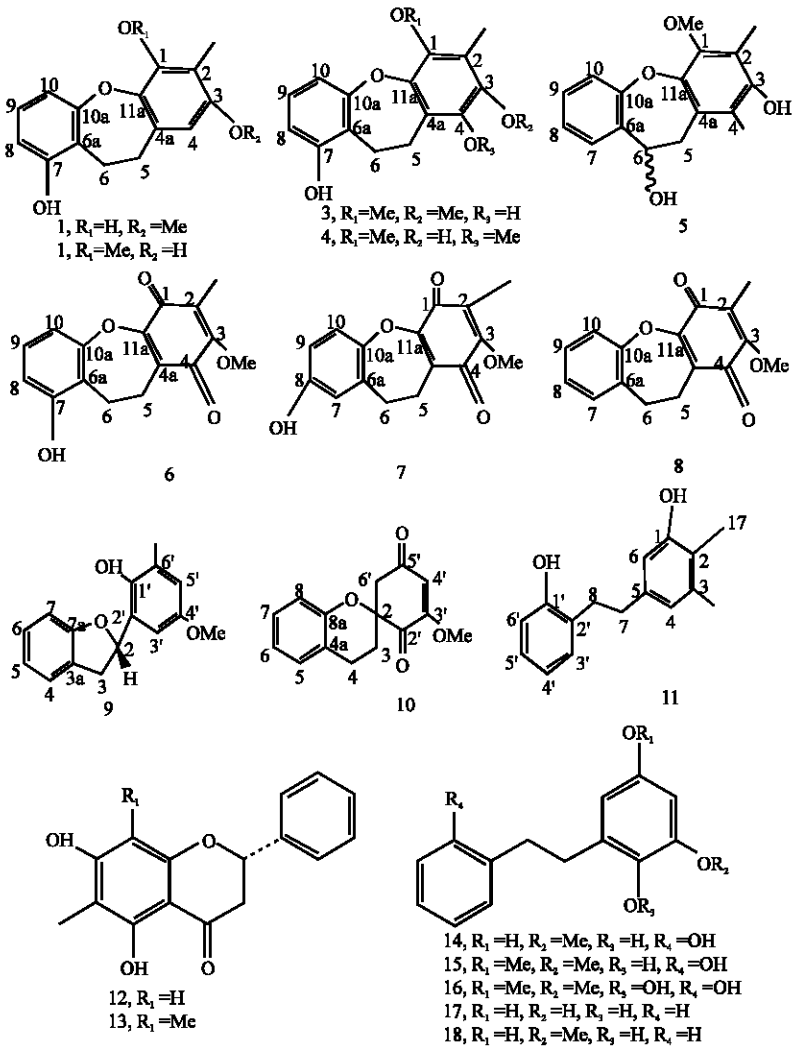

Fig. 8: Structure of oxepins, flavones and bibenzyls

less than standard drug (Chandrashekar *et al*., 2009a, b). The ethyl acetate extract of stem bark of *Bauhinia purpurea* were found good analgesic activity tested at dose level 400 mg kg^{-1} by acetic acid induced writhing model and hot plate method (Chandrashekar *et al*., 2009a).

Antimalarial, antimycobacterial, antifungal and cytotoxicity activities: The isolated compounds from roots exhibited antimycobacterial activity with MIC valve ranging from 24.4 to 740.7 μM. Among all compounds bauhinoxepin J is a potent antimycobacterial agent activity having MIC 24.4 μM. Among the isolated metabolites, compounds 6, 7, 8 and 13 exhibited antimalarial activity (IC_{50} 5.8-11.2 μM), while compounds 1, 4, 9, 15 and 18 exhibited antifungal activity (IC_{50} 49.6-130.1 μM). Compounds 1, 2, 4, 6, 7, 8 and 18 exhibited cytotoxicity towards KB and BC cell line with IC_{50} values ranging from 10.5 to 72.3 μM. Compound 4 and 7 posses potent anti-inflammatory activity inhibiting the COX-2 enzyme with IC_{50} value of 6.9 and 10.1 μM respectively (Fig. 8) (Boophong *et al*., 2007).

Anti-diabetics: The rat showing blood glucose level 250-350 mg dL^{-1} were considered as diabetic rat, induced by alloxan. The hypoglycemic activity of ethanolic extract and purified fraction-1 of stem of *B. purpurea* were studied and found that the dose of 100 mg dL^{-1} (i.p.) reduces serum glucose level of Wister rats due to inhibition of cyclooxygenase and promote β-cell regeneration (Muralikrishna *et al*., 2008).

Cardiac activity: The cardiotonic activity of purified fraction-1 of ethanolic extract of stem of *B. purpurea* were studied and found that the fraction-1 has exhibited positive inotropic and chronotropic effect on isolated frog's heart. Its action is blocked by β_2-adrenergic blocker propranolol. The characterization of the isolated compound based on structural studies is under progress (Muralikrishna *et al*., 2008).

Hormone regulation: The aqueous alcoholic bark extract of *B. purpurea* (2.5 mg kg^{-1} b.wt.) and aqueous root extract *Withania somnifera* (1.4 g kg^{-1} b.wt.) on daily administration for 20 days, stimulating thyroid function in female mice. Both the plant extracts showed an increase in hepatic glucose-6-phosphatase (G-6-Pase) activity and antiperoxidative effects as indicated either by a decrease in hepatic lipid peroxidation (LPO) and/or by an increase in the activity of antioxidant enzyme(s). Serum triiodothyronine (T_3) and thyroxine (T_4) concentrations were increased significantly by *Bauhinia, Withania* could enhance only serum T_4 concentration (Panda and Kar, 1999). In Panda *et al*. (2003) studied the role of *Emblica officinalis* L. and *Bauhinia purpurea* L. extracts in regulating thyroid functions was studied in male mice. Oral administration of *Emblica officinalis* L. fruit extract at 30 mg kg^{-1} body weight (b.wt.) each day for 20 days decreased serum T_3 and T_4 concentrations and hepatic O_2 consumption. In contrast daily administration of *B. purpurea* at 2.5 mg kg^{-1} b.wt. each day for 20 days increased serum T_4 concentration and O_2 consumption. Both the plant extracts exhibited hepatoprotective effects as evidenced by decreased lipid per oxidation (Panda *et al*., 2003).

Antioxidant activity: The antioxidant activity of ethanolic extract (95% v/v) of leaves of *B. purpurea* exhibited significant free radical scavenging activity and reducing power activity when compare with ascorbic acid. The IC_{50} values were found to be 78.31 and 59.37 μg mL^{-1} for ethanolic extract of leaves of *B. purpurea and* ascorbic acid, respectively (Joshi *et al*., 2009). The ethanolic extracts of aerial parts do not shows antioxidant activity (Silva *et al*., 2005).

Nephroprotective: The ethanolic extract of leaves and unripe pods of *B. purpurea* shows protective action on kidney induced by gentamicin induced nephrotoxicity. Extracts were administered intraperitoneal at dose level 300 mg/kg/day for eight days reduces blood vessel congestion, epithelial desquamation, accumulation of anti-inflammatory cells and necrosis of kidney cells. This normalizes the increased level of serum creatinine, uric acid, urea and blood urea nitrogen (Lakshmi *et al*., 2009).

Wound healing activity: Four different models excision, incision, burn and dead space wound were used to determine wound healing properties of chloroform and methanol extracts of leaves of *B. purpurea*. Low dose 2.5% (w/w) and high dose 5% (w/w) of chloroform and methanol extracts were prepared in hydrophilic and hydrophobic bases for excision, incision, burn wound models applied topically. Aloe vera 5% (w/w) was used as a standard. For dead space wound model

100 and 500 mg kg^{-1} and as a standard Aloe vera 300 mg kg^{-1} were given orally. *B. purpurea* is having almost equal activity with Aloe vera in all four wound healing models (Ananth *et al*., 2010).

Anti-diarrheal activity: The ethanolic extract of leaves shows inhibitory effect at different dose level on animal models castor oil induced diarrhea in rats and gastrointestinal motility test by using charcoal meal. This inhibitory effects support the use of the leaves of *B. purpurea* in folklore medicine (Mukherjee *et al*., 1998).

CONCLUSIONS

The scientific research on *B. purpurea* is suggests a huge biological potential of this plant. It is strongly believed that detailed information as presented in this review on the phytochemical and various biological properties of the extracts might provide detailed evidence for the use of this plant in different medicines. The phytochemical variations and efficacy of the medicinal values of *B. purpurea* is dependent on geographical locations.

Even today, plants are the almost exclusive source of drugs for a majority of the world population. Therefore, it remains a challenge for scientist to provide efficient, safe and cheap medication especially for rural area. These *Bauhinia* species and their quantification of individual phytoconstituents as well as pharmacological profile based on *in vitro*, *in vivo* studies and on clinical trial should be further investigated.

REFERENCES

Ananth, K.V., M. Asad, N.P. Kumar, S.M.B. Asdaq and G.S. Rao, 2010. Evaluation of wound healing potential of *Bauhinia purpurea* leaf extracts in Rats. Indian J. Pharm. Sci., 72: 122-127.

Asolkar, L.V., K.K. Kakkar and O.J. Chakre, 2000. Second Supplement to Glossary of Indian Medicinal Plants With Active Principles. National Institute of Science Communication, New Delhi.

Bhartiya, H.P., P. Dubey, S.B. Katiyar and P.C. Gupta, 1979. A new chalcone glycoside from *Bauhinia purpurea*. Phytochemistry, 18: 689-689.

Bhartiya, H.P. and P.C. Gupta, 1981. A chalcone glycoside from the seeds of *Bauhinia purpurea*. Phytochemistry, 20: 2051-2051.

Boophong, S., P. Puangsombat, A. Barmee, C. Mahidol, S. Ruchirawat and P. Kittakoop, 2007. Bioactive compounds from *Bauhinia purpurea* possessing antimalarial, antimycobacterial, antifungal, anti-inflammatory and cytotoxic activities. J. Nat. Prod., 70: 795-801.

Chandrashekar, K.S., T. Kumar, A.B. Joshi, Santanu, S. and Hitesh *et al*., 2009a. Anti-inflammatory activity of *Bauhinia purpurea* stem barks extract against carageenan induced rat paw edema. Herbal Heritage, 1: 42-45.

Chandrashekar, K.S., T. Kumar, M.P. Gururaj and H. Joshi, 2009b. Analgesic activity of *Bauhinia purpurea* Linn. Herbal Heritage, 1: 94-96.

Chatterjee, A. and S.C. Pakrashi, 1992. The Treatise of Indian Medicinal Plants. Vol. 2, Council of Scientific and Industrial Research, New Delhi.

Chopra, R.N., S.L. Nayar and I.C. Chopra, 1996. Glossary of Indian Medicinal Plants. CSIR, New Dehli, ISBN: 8172361262.

Das, A.K., B.K. Datta and G.D. Sharma, 2008. Medicinal plants used by different tribes of Cachar district, Assam. Ind. J. Trad. Knowledge, 7: 446-454.

Gurib-Fakim, A., 2006. Medicinal plant: Traditions of yesterday and drugs of tomorrow. Mol. Aspects Med., 27: 1-93.

Jha, L.K., 1995. Advances in Agroforestry. APH Publishing Corporations, New Delhi, India, pp: 669.

Jones, D.T. and P. German, 1993. Flora of Malaysia. Oxford University Press, Oxford, pp: 154.

Joshi, V.D., T. Verma and P.R. Shetty, 2009. Antioxidant potential of *Bauhinia purpurea* Linn. leaves. Int. J. Pharm. Res., 1: 51-55.

Kalakoti, B.S. and Y.P.S. Pangtey, 1988. Ethno-medicine of Bhotia tribes of Kumaon Himalaya, UP. Bull. Med. Ethno. Bot. Res., 9: 11-20.

Kamble, S.Y., S.R. Patil, P.S. Sawant, S. Sawant, S.G. Pawar and E.A. Singh, 2010. Studied on plant used in traditional medicine by Bhilla tribe of Maharashtra. Indian J. Trad. Knowledge, 9: 591-598.

Khare, C.P., 2004. Encyclopaedia of Indian Medicinal Plant. Springer–Verlag, New York, pp: 95-96.

Kritikar, K.R. and B.A. Basu, 1991. Indian Medicinal Plants. 2nd Edn., Periodical Experts Book Agency, New Delhi, India, pp: 856-860.

Kuo, Y.H., M.H. Yeh and S.L. Huan, 1998. A novel 6- butyl-3-hydroxyflavanone from heartwood of *Bauhinia purpurea*. Phytochemistry, 49: 2529-2530.

Kurian, J.C., 2004. Plant that Heal. 7th Edn., Oriental Watchman Publishing House, Pune, pp: 31.

Lakshmi, B.V.S, N. Neelima, N. Kasthuri, V. Umarani and M. Sudhakar, 2009. Protective Effect of *Bauhinia purpurea* on gentamicin induced nephrotoxicity in rat. Indian J. Pharm. Sci., 71: 551-554.

Mukherjee, P.K., T.K. Gopal and T. Subburaju, 1998. Studies on the anti-diarrheal profiles on *Bauhinia purpurea* Linn. leaves extract. Nat. Prod. Sci., 4: 234-237.

Muralikrishna, K.S., K.P. Latha, C.S. Shreedhara, V.P. Vaidya and A.M. Krupanidhi, 2008. Effect of *Bauhinia purpurea* Linn. on alloxan-induced diabetic rats and isolated frogs heart. Int. J. Green Pharm., 2: 83-86.

Panda, S. and A. Kar, 1999. *Withania somnifera* and *Bauhinia purpurea* in the regulation of circulating thyroid hormone concentration in female mice. J. Ethnopharmacol., 67: 233-239.

Panda. S., A. Karr and S. Bharti, 2003. Regulation of thyroid function in mice with extract of *Emblica officinalis* L. and *Bauhinia purpurea* Linn. J. Herb Spices Med. Plants, 10: 1-9.

Patil, V.K., 2003. Prospect and Potential of Medicinal and Aromatic Plant in Chhattisgarh. IG Agriculture University, Raipur, India, pp: 17.

Patil, G.G., P.Y. Mali and V.V. Bhadane, 2008. Folk remedies used against respiratory disorders in Jalgaon district, Maharashtra. Nat. Prod. Radiance, 7: 354-358.

Pawar, S. and D.A. Patil, 2007. Ethnomedicinal uses of barks in Jalgaon district. Nat. Prod. Radiance, 6: 341-346.

Pettit, G.R., A. Numata, C. Iwamoto, Y. Usami, T. Yamada, H. Ohishi and G.M. Cragg, 2006. Antineoplastic agent 551 isolation and structure of Bauhiniastatins-1-4 from *Bauhinia purpurea*. J Nat. Prod., 69: 323-327.

Ragasa, C.Y., J.G. Hofilena and J. Rideout, 2004. Secondary metabolite from *Bauhinia purpurea*. J. Sci. Food Agric., 55: 423-431.

Rajaram, N. and K. Janardranan, 1991. Chemical composition and nutritional potential of the tribal pulse, *Bauhinia purpurea*, *B. racemosa* and *B. vahlii*. J. Sci. Food Agric., 55: 423-431.

Ramadana, M.F., G. Sharanabasappab, Y.N. Seetharamb, M. Seshagiric and J.T. Moerseld, 2006. Characterisation of fatty acids and bioactive compounds of kachnar (*Bauhinia purpurea* L.) seed oil. Food Chem., 98: 359-365.

Ramchandra, R. and B.C. Joshi, 1967. Chemical examination of *Bauhinia purpurea* flower. Curr. Sci., 36: 574-575.

Shreedhara, C.S., V.P. Vaidya, H.M. Vagdevi, K.P. Latha, K.S. Muralikrishna and A.M. Krupanidhi, 2009. Screening of *Bauhinia purpurea* Linn. for analgesic and anti-inflammatory activities. Indian J. Pharmacol., 41: 75-79.

Silva, C.G., R.S. Herdeiro, C.J. Mathias, A.D. Panek and C.S. Silveira *et al*., 2005. Evaluation of antioxidant activity of Brazilian plants. Pharmacol. Res., 52: 229-233.

Verma, T. and K.S. Chandrashekar, 2009. a- amyrin caprylate–A new triterpene isolated from the leaf of *Bauhinia purpurea* linn. Asian J. Res. Chem., 2: 569-570.

WHO., 1993. Research Guideline for Evaluating the Safety and Efficacy of Herbal Medicines. WHO., Manila, Philippines, pp: 2.

Wassel, M., S.M. Abdel-Wahab and N.M. Ammar, 1986. Constituents of the essential oils from *Bauhinia variegata* L. and *Bauhinia purpurea* L. flowers. Sci. Pharm., 54: 357-361.

Yadav, R.N. and P. Tripathi, 2000. A novel flavone glycoside from the stem of *Bauhinia purpurea*. Fitoterapia, 71: 88-90.

Yadav, R.N. and S. Sodhi, 2001. A novel flavone glycoside-6-4-diahydroxy-3-prenyl-3,7,5,7-tetramethoxy flavone-6-O-a-L-rhamnopyranosidewas isolated from seed of *Bauhinia purpurea*. Asian J. Chem., 13: 529-533.

Yadav, S. and B.K. Bhadoria, 2001. Chemical and biochemical assessment of some leguminous tree leaves. Indian J. Anim. Nutr., 18: 113-118.

Yadav, S. and B.K. Bhadoria, 2005. Two dimeric flavonoids from *Bauhinia purpurea*. Ind. J. Chem., 44: 2604-2607.

Yamamoto, K., Y. Konami, K. Kusui and T. Osawa, 1991. Purfication and characterization of a carbohydrate-binding peptide from *Bauhinia purpurea* lectin. FEBS Lett., 281: 258-262.

Zakaria, Z.A., Y.W. Loo, N.I. Abdul-Rahman, A.H. Abdul-Ayub, M.R. Sulaiman and G.H. Kumar, 2007. Antinociceptive, anti-inflammatory and antipyretic properties of *Bauhinia purpurea* leaves aqueous extract in experimental animals. Med. Prin. Prac. 16: 443-449.

Zakaria, Z.A., N.I.A. Rahman, Y.W. Loo, A.H.A. Ayub and M.R. Sulaiman *et al*., 2009. Antinociceptive and anti-inflammatory activities of the chloroform extract of *Bauhinia purpurea* L. (Leguminosae) leaves in animal models. Int. J. Trop. Med., 1: 140-145.