AN UPDATE ON AYURVEDIC HERB KACHHNAR (BAUHINIA PURPUREA LINN.) - A REVIEW

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ABSTRACT: Bauhinia Purpurea commonly known as purple orchid tree, belonging to the family Caesalpinaceae, sparingly grown in India. The use of natural products as medicinal agents presumably predates the earliest recorded history. It is a species of flowering plant used in several traditional medicine system 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 active chemical compound including 5,6-Dihydroxy-7-methoxyflavone 6-O-β-D xylopyrano- Side, bis[3,4-dihydroxy-6-methoxy-7,8-furano-5,6-monomethylalloxy]-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], biflavonoid, bibenzyls, dibenzoxepins, mixture of phytol fatty esters, lutein, β-sitosterol, isoquercitin and astragalin etc. The present review discuss medicinal properties, Biological activity, Phytochemistry and Pharmacology of Bauhinia Purpurea.

INTRODUCTION: Various Medicinal plants have been used for centuries as remedies for disease because they contain components of therapeutic values. According to the WHO, 80% of the world population continues to rely mainly on traditional medicine for their health care1. The well-known and well established genus Bauhinia comprises of trees and shrubs that grow in warm climate. It is rare in southern most district, 5-7 m tall tree in deciduous forests which is often planted in gardens along roadside for its large purple beat flowers.

The leaves are 10-20 cm long and broad, rounded, alternate and bilobed at the base and apex. The flower are conspicuous, pink and fragrant, with five petals. The fruit is a pod 30 cm long, containing 12-16 seeds and have long seed as pea. Flowers and fruit appear in the month of December2.

Plant Profile:
It is small to medium-sized deciduous tree growing up to 17 m tall. The leaves are 7.5-15 cm long rather than longer than broad, cleft about half way down into two acute or rounded bilobed very minutely pubescent beneath when young, base usually cordate, 9-11 nervd, petiole 2.25-3.8 cm long. The bark ashy to dark brown pubescent. The flowers are conspicuous, pink and fragrant with five petals. Pedicels 5-13mm long, stout, tementose, bract and bracteoles small tementose, deltoid petals 3.8 to 5cm long ob lanceolate long
clawed, spreading veined. Stamens usually three fertile, other reduced to antherless filaments. Ovary downy, long-stalked; Style long; Stigma large, oblique.  

**FIG. 1: LEAVES OF BAUHINIA PURPUREA**

**Indian Name:**
In India, it is known by its vernacular name, the most commonly used are

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<th>English</th>
<th>Hindi</th>
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<td>Butterfly Tree</td>
<td>Kaniar</td>
<td>Devakanchan</td>
<td>Raktachandan</td>
<td>Nilattiruvatti</td>
<td>Koiral</td>
<td>Oy-yok</td>
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**Geographical Distribution:**
*Bauhinia Purpurea* is native to China and found throughout India, ascending to an altitude of 1300 m in the Himalayan. *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. The genus Bauhinia, consisting of 300 species. In the United State of America, the tree grows in Hawaii, coastal California, southern Texas and southwest Florida.

**Medicinal Uses:**
The young pods and mature seeds of kachnar are known to be cooked and eaten by tribes such as the Kathkors and Gondas of India. *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. Species of Bauhinia are rich in polyphenolics and are known for its medicinal properties. 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 boil and abscesses. The decoction of flower is worked as a laxative. There is no documentation on its traditional use to treat disease among to treat, ailments like glandular swellings, skin disease, ulcer, diarrhea, stomach tumor and wounds.

**Ethnomedicinal Use of Different Parts of Bauhinia Purpurea Linn.:**

**Whole Plant:** The whole plant is used in dropsy, pain, rheumatism, convulsions and septicemia.

**Flower:** The Flower bud and flower fried in ghee are reported to be given to patients suffering from dysentery.
Bark: The concentrated decoction of bark is used to treat lymph adenitis by tribal people of Jalgaon District. The decoction of stem bark orally twice a day is very effective in asthama and other respiratory disorder as an anti-inflammatory agent. Also bark juice is useful in menstruation trouble and with honey is taken orally against leucorrhea.

Root: Root bark is mixed with curd and used in hemmorhoids. Its paste with dried ginger applied internally in the treatment of goiter. The root is carminative. Infusion of small piece of root is used for the treatment of white spot on race.

Phytochemistry of Bauhinia Purpurea:
Bauhinia 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 plants of B. Purpurea two new oxepins named bauhiniastatins 1 and 2 have been isolated and the ethanolic extract of root provides bauhiniastatins 1, 2, 3 pacharin (Fig. 2) exhibit significant growth inhibition against a minipanel of human cancer cell lines. The structure have been established on the basis of chemical evidence and spectroscopy methods. A novel flavones glycoside, 5,6-dihydroxy-7-methoxyflavone 6-O-b-D-xylopyranoside (Fig 3) was isolated from the chloroform-soluble fraction of the ethanolic extract of B. Purpurea stems.

Three glycerol derivatives and 6-butyl-3-hydroxyflavone derivatives are 2, 3-dihydroxypropyl oleate, 2, 3 dihydroxypropyl linoleate, 2, 3-dihydroxypropyl 16-hydroxydecanoate and 6-butyl-3-hydroxyflavone, 6-(3”-oxobutyl)-taxifolin (Fig. 4) respectively isolated from methalonic extract of heartwood of B. Purpurea.

The two new dimeric flavonoids namely bis [3’, 4’-dihydroxy-6-methoxy - 7, 8 - furano - 5’, 6’-monomethylalloxy]-5- C - 5 - biflavonyl and (4’hydroxy-7-methyl 3- C-a-rhamnopyranosyl)-5-C-5-(4’-hydroxy-7- methyl - 3 – C – a - D-glucopyranosyl) bioflavonoid (Fig. 5) with protein precipitating properties obtained from 70% aq. Acetone extract of B. purpurea leaves. The leaves of B. purpurea also afforded a mixture of phytol fatty esters, leutin and β-sitosterol (Fig. 6). The petroleum ether fraction of ethanolic extract (95%) of B. 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.

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). The aqueous methanolic extract of fresh flower of B. purpurea gives flavonoid quercetin and flavonoid glycosides isoqueecitin, astragalin (Fig. 7) 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 H2SO4 for 12 hr gave butein and a disaccharide, the component sugars which were found as galactose and arabinose. A new glycoside 3,4-dihydroxychalcone 4-O-β-L-arabinopyranosyl-O-β-D-galactopyranoside 9mp 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 H2SO4 for 12 hr).

The identity of sugars was confirmed by co-chromatography with authentic samples and by the preparation of their osazones. After chalcone glycoside a novel flavon glycoside were isolated, Glycoside-6’-Dihydroxy-3’-prenyl- 3, 7, 5, 7’-Tetramethoxy Flavone-6-O-α-L-rhamnopyranoside (Fig. 8) from acetone soluble of ethanolic extract from seed of B. purpurea which gives positive test for Molisch and structure are confirmed by spectral data analysys. The CH2Cl2 extract of root of B. purpurea on purification yield 11 new compounds bauhinoxepin C-J, bauhinobenzofurin A, bauhispirorin A, bauhinol E, two flavanones (-)-stroboxinin and demethoxymatteucinol and five known bibenzyls (Fig. 9) which posses various pharmacological activities. All the compound 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. B-Tocopherol was the major tocopherol isomer with the rest being d-tocopherol. 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 of lactose-Sepharose 4B or lactose-, maltose-, fucose- and di-N-acetylchitobiose-Sepharose and by solid phase synthesis. This peptide exhibits lactose binding activity in the presence of calcium.
FIG. 5: STRUCTURE OF DIMERIC FLAVONOIDS

FIG. 6: STRUCTURE OF LEUTIN AND BETA-SITOSTEROL

FIG. 7: STRUCTURE OF FLAVONOIDS AND FLAVONOID GLYCOSIDES

FIG. 8: STRUCTURE OF NOVEL FLAVONE GLYCOSIDE
Pharmacological Properties of *Bauhinia Purpurea*:

**Antinociceptive, analgesic and antipyretic activity:**
The aqueous extract of leaf of *B. purpurea* possesses good antinociceptive, analgesic and antipyretic. The crude dried extract of was prepared in doses of 6.0, 30.0 and 60.0 mg/kg and subjected to the respective. They have used antinociceptive (abdominal constriction, hot plate and formalin tests), and antipyretic (brewer’s yeast-induced pyrexia test) assays. The 6.0 mg/kg AEBP exhibited the highest antinociceptive activity. 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 ASA. In Zakaria et al. (2009) established the antinociceptive activity of chloroform extract of *B. purpurea* leaves using animals models. Analgesic activity 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) were carried out following the intraperitoneal administration of extract at dose level 50 and 100 mg/kg. Dose of 100 mg/kg was comparable with standard drugs. The ethyl acetate extract of stem bark of *Bauhinia purpurea* were found good analgesic activity tested at dose level 400 mg/kg by acetic acid induced writhing model and hot plate method.

**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 β2-adrenergic blocker propranolol. The characterization of the isolated compound based on structural studies is under progress.

**Hormone regulation:**
The aqueous alcoholic bark extract of *B. purpurea* (2.5 mg/kg body weight) and aqueous root extract *Withania somnifera* (1.4 g/kg body weight) 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 (T3) and thyroxine (T4) concentrations were increased significantly by *Bauhinia Withania* could enhance only serum T4 concentration.

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 body weight each day for 20 days decreased serum T3 and T4 concentrations and hepatic O2 consumption. In contrast daily
administration of *B. purpurea* at 2.5 mg/kg body weight each day for 20 days increased serum T₄ concentration and O₂ consumption. Both the plant extracts exhibited hepatoprotective effects as evidenced by decreased lipid per oxidation⁴⁹.

**Nephroprotective:**
The ethanolic extract of leaves and unripe pods of *B. purpurea* shows protective action on kidney induced by gentamycin induced nephrotoxicity. Extracts were administered intraperitoneal at dose level 300 mg/kg/day for 8 days reduced 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 nitrogen⁴⁰.

**Wound healing activity:**
Four different models excision, incision, burn and space wound were used to determine wound healing properties of chloroform and methanol extracts of leaves of *B. purpureae*. Low dose 2.5% (w/w) of chloroform and methanol extracts were prepared in hydrophilic and hydrophobic bases of 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 and as a standard Aloe vera 300 mg/kg were given orally. *B. purpurea* is having almost equal activity with *Aloe vera* in all four wound healing models⁴¹.

**Antidiarrheal 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 medicine⁴².

**Antibacterial and anti-fungal activity:**
The antimicrobial activity of leaf extract was determined in aqueous and organic extracts and the minimum inhibitor concentration (MIC) against six species of pathogenic and non-pathogenic microorganism – *Bacillus subtilis*, *staphylococcus aureus*, *salmonella typhi*, *Escherichia coli*, *pseudomonas aeruginosa* and *candida albicans* using the disk diffusion method. The chemical constituent organic plant extract were separated by Thin layer chromatography and purified by column chromatography and further identified by gas chromatography-mass spectrometry (GC-MS) analysis. Significant inhibitory activity was observed with methanol extracts of plant against the test microorganisms while less antibacterial activity was observed in hexane, acetone and aqueous extracts ⁴³.

**Antioxidant activity:**
It explored as well as compared the antioxidant activity of the different plant parts of *B. purpurea* Linn, 1,1-diphenyl-2-picrylhydrazyll (DPPH) free radical scavenging and nitric oxide (NO) scavenging capacity were measure to determine the antioxidant activity of both leaves and bark of the plant. Solvent-solvent partitioning was accomplished to obtain extracts of different polarities as n-hexane, ethyl acetate, and methanol extract. All the extracts exhibited potent antioxidant activity in terms of DPPH and NO scavenging capacity ⁴⁴.

**Antidiabetic activity:**
(a) It revealed that the bark of *Bauhinia purpurea* linn. was traditionally used as an astringent in diarrhea, flower are laxative. The study was undertaken to evaluate antidiabetic activity of *B. purpurea* stem extract of chloroform , methanol, petroleum ether, ethyl acetate and was evaluated on mice i.e. alloxan induced diabetes in mice by glucometer method and higher values showed the significant values⁴⁵.

(b) It evaluated anti diabetic activity of ethanol extract of *Bauhinia Purpurea* linn plant parts, viz stem, root, leaf and flowers in wistar rats. Diabetes Mellitus was induced in rat by single intraperitoneal injection of streptozotocin (STZ, 50 mg/kg body weight). After STZ induction, the hyperglycemic rats were treated with all three extracts orally at the dose 200 mg/kg body weight daily for 15 days. Gliven clamide (0.5 mg/kg body weight p.o.) was used as reference drug. The fasting blood glucose levels were measured on every 5th day during the 15 day treatment. All the extract at 100, 200, 400 mg/kg orally significantly (p<0.001) exhibited antidiabetic activity in STZ-induced diabetic rats by reducing and normalizing
the elevated fasting blood glucose level as compared to those of STZ control group. The methanol extract was most active.

(c) The rat showing blood glucose level 250-350 mg/dl 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 (i.p.) reduces serum glucose level of Wistar rats due to inhibition of cyclooxgenase and promote β-cell regeneration.

**Anti-inflammatory activity:**

It reviewed large group of medicinal plants including B. purpurea which were used as traditional medicine and have potential to cure various ailments and reported that medicinal plants have potent anti-inflammatory activity. Various models tested for anti-inflammatory activity. Carrageenan, Histamine, Dextran, Serotonin, induced hind paw oedema, cotton pellet induced granuloma Freund’s Adjuvant were the standard experimental models of acute and sub-acute and chronic inflammation respectively. The test phytodrugs were effective in all the models of inflammation.

**Anti ulcer activity:**

This reviewed the plants who have efficacy to protect or treat gastric ulcer induced by various factors. B. purpurea and other plants had been screened by in vivo and in vitro, possessing anti-ulcer activity and can be used as a alternate source to treat ulcer.

**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 the compounds bauhinaxepins 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 (IC₅₀ 5.8-11.2 µM), while compounds 1, 4, 9, 15 and 18 exhibited antifungal activity (IC₅₀ 49.6-130.1 µM) Compound 1, 2, 4, 6, 7, 8, and 18 exhibited cytotoxicity towards KB and BC cell line with IC₅₀ values ranging from 10.5 to 72.3 µM. Compounds 4 and 7 posses potent anti-inflammatory activity inhibiting the COX-2 enzyme with IC₅₀ value of 6.9 and 10.1 µM respectively.

**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 variation and efficacy of the medicinal values of B. purpurea is dependent on geographical locations.

Even today, plant 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 speciesand their quantification of individual phytococonstituents as well as pharmacological profile based on in vitro, in vivo studies and on clinical trial should be further investigated.

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