**MEDICINAL USE OF *Bauhinia variegate (*Kachnar)**

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**Abstract**

*Bauhinia* tree parts have anti-bacterial, anti-fungal, anti-malarial, pain reducing, swelling reducing, cytotoxic, fever reducing and thyroid hormone regulating properties. In Ayurveda, the tree is used extensively for treating skin and glandular diseases, leprosy, intestinal worms, tumours, wounds, ulcers, inflammations, scrofula, protoptosis, haemorrhoids, haemoptysis, cough, menorrhagia and bleeding disorders. *Bauhinia variegate* have a phytochemical ,Pharmacological properties. The various phytochemical present in it are flavonoids, glycosides, alkaloids, tannins and terpenoids which act as active biological constituents.

**Keywords**-*Bauhinia variegate,*flavonoids, glycosides, alkaloids, tannins

**Morphology**

***Bauhinia variegata*** is a small to medium-sized deciduous tree with a short bole and spreading crown, attaining a height of up to 15 m and diameter of 50 cm. In dry forests, the size is much smaller. The bark is light brownish grey, smooth to slightly fissured and scaly. Inner bark is pinkish, fibrous and bitter. The twigs are slender, zigzag; when young, light green, slightly hairy, and angled, becoming brownish grey.Leaves have minute stipules 1-2 mm, early caducous; petiole glabrous, 3-4 cm; lamina broadly ovate to circular, often broader than long, 6-16 cm diameter; 11-13 nerved; tips of lobes broadly rounded, base cordate; upper surface glabrous, lower glaucous but glabrous when fully grown.Flower clusters (racemes) are unbranched at ends of twigs. The few flowers have short, stout stalks and a stalk like, green, narrow basal tube (hypanthium). The light green, fairly hairy calyx forms a pointed 5-angled bud and splits open on 1 side; 5 curved stamens; very slender, stalked, curved pistil, with narrow, green, 1-celled ovary, style and dot like, remaining attached; petals 5, slightly unequal, wavy margined and narrowed to the base stigma.

**Habitat**

In its natural habitat in India, the tree is deciduous, remaining leafless from Jan-Feb to April with leaf fall in Nov-Dec. Flowering occurs when the plant is leafless. Tree starts flowering at a very early age of 2-3 years. The seeds disperse from the pods and germinate on sites with favourable light and moisture conditions, while in unfavourable niches the radicle dries up or is destroyed by birds.

**Medicinal uses**

It is used for the treatment of bleeding hemorrhoids, cough, diarrhea, dysentery, heartburn, hematuria, indigestion, malaria, menorrhagia, skin diseases, sore throat, TB, dyspepsia, bronchitis, leprosy, ulcer, obesity and worms**.** It is also used as an astringent, tonic and anthelmintic.Kachnar flowers along with buds of kachnar could be cooked for the meal and may even be consumed in the form of a medicine so as to get a number of advantages for the health, like the treatment of numerous illness and ailments. Kachnar is a wonderful veggie that grown in spring and served cooked with many delicacies. The kachnar buds is an extremely delicious as well as healthy source of food for all of us. The buds of kachnar are incredibly beautiful as well as delicate.

*Bauhinia* tree parts have anti-bacterial, anti-fungal, anti-malarial, pain reducing, swelling reducing, cytotoxic, fever reducing and thyroid hormone regulating properties. In Ayurveda, the tree is used extensively for treating skin and glandular diseases, leprosy, intestinal worms, tumours, wounds, ulcers, inflammations, scrofula, protoptosis, haemorrhoids, haemoptysis, cough, menorrhagia and bleeding disorders.

 (<http://www.chandigarhayurvedacentre.com/KachnarBenefitsandMedicalUsage>).

 **Table 1.1** Showing Medical Uses of *Bauhinia variegata*

|  |  |  |
| --- | --- | --- |
| **S.No.** |  **Disease** |  **Treatment with *Bauhinia variegata*** |
|  **1** | **Goiter (Galaganda, Gandamala)** | 14-28 ml decoction of stem bark is given thrice daily or 14-28 gram paste of stem bark is given with 25-100 ml rice water thrice daily. |
|  **2** | **Tonsils, Thyroid Problem** | Boil bark (20 gm) in water (200 ml) till water reduces to 50 ml filter and drink. |
|  **3** | **Jaundice, Liver related problems** | For Jaundice grind leaves of Kachnar to extract juice. This juice can be taken twice a day. Dose for adult patient is 100 ml and for children is 15 ml.This improves liver function and also helpful in curing liver enlargement. |
|  **4** | **Mouth Ulcers, Bad Breath** | Take bark (10 gm) of Kachnar tree and boil in water (400 ml) till volume reduces to 100 ml. Filter and gargle frequently. |
|  **5** | **Diarrhoea** | Take dried bark and ground to make powder. Take this powder (3 gm) twice a day. |
|  **6** | **Loss of appetite** | Drink leaves juice of Kachnar. |
|  **7** | **Burning Sensation in Urine, Urinary Problems** | Take bark (10 gm), coriander seeds (4 gm) and cook in 250 ml of water. Filter, add misri and drink. |
|  **8** **9** | **Weakness****Cysts In Uterus, Fibroids, Tumours** | Dry flowers of kachnar in shade and grind to make powder.Take dry bark (5 gm) or fresh bark (10 gm) and boil in 400 ml water till it reduces to 100 ml. Filter and drink. This is also helpful in curing hormonal imbalance. |
|  **10** | **Multinodular tuberculosis** | 1. Take 10-20 gm bark and boil in 400ml water till water is reduced to 1/4th. Give this water to the patient. It cures multinodular tuberculosis.2. Add 1 gm dry ginger powder in 20 gm decoction of its bark. Give this water to the patient every morning and evening.3. Give 10-20 gm decoction of its bark or flowers with honey twice a day. It cures multinodular tuberculosis and also purifies blood.4. Mix 250 gm bark powder with 250 gm sugar. Give 5-10 gm of this mixture every morning and evening with milk or water. |
|  **11** | **Dyspesia** | Give decoction of 10-20 gm of its root every morning and evening it cures dyspepsia. |
|  **12** | **Flatulence** | Give the decoction of its root with 3 gm. Ajwain powder. It cures the swelling of stomach due to indigestion |

 **Medicines with kachnar as ingredient**

 **Table 1.3** Showing Medicines Including *Bauhinia variegata* as Ingredient

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Name of Medicine** |  **Uses** |
|  **1** | Kachnar Guggul | A very famous ayurvedic tablet for curing goiter |
|  **2** | Chandanasava | Used as cardiac and digestive tonic |
|  **3** | Chitrakadi taila | An herbal oil used to apply into the fistula tract to bring about quick healing |
|  **4** | Ushirasava | A liquid medicine used in treating heavy menstrual bleeding, skin diseases |
|  **5** | Mutra Sangrahaniya Kwatha | Used in UTI (Urinary Tract Infection) |
|  **6** | Gandamala Kandana Rasa | Used in goiter, cervical lymphadenitis. |

**Anti-inflammatory activity**

Phytochemical analysis of non woody aerial parts of *Bauhinia variegata*yielded flavonoids with one triterpene caffeate. These seven compounds showed anti- inflammatory activity, they inhibited the lipopolysaccharides and interferon γ induced nitric oxide (NO) and cytokines(Koteswara *et.al.,* 2008).

**Anti-ulcer activity**

In gastric ulcer induced by pyloric ligation and in aspirin induced ulcer model in rats, the ethanolic extract of *B.variegata* decrease the volume of gastric secretion, total free acidity and ulcer index ( Rajkapoor *et.al.,*2003).

**Molluscicidal effects**

The molluscicidal activity of *Bauhinia variegata* leaf was studied against vector snail *Lymnaea acuminata*. The toxicity of the plant was time and concentration-dependent. Among organic extracts, ethanol extracts of the plant were more toxic. The toxicity of *B. variegata* leaf ethanolic extract was (96h LC50- 14.4 mg/L). The 24h LC50of column purified fraction of *B. variegata*was 20.3 mg/L. Saponin and quercetin were characterized and identified as active molluscicidal component (Singh *et.al.,* 2012).

**Effect on wound healing**

Excision and incision wound models in albino Wistar rats, were used to evaluate the wound healing activity of the ethanolic and aqueous extracts of root of *Bauhinia variegata* at dose of 200 and 400 mg/kg bw. Both aqueous and ethanolic extracts of root of *Bauhinia variegata*at both doses produced significant wound healing by excision and incision wound models, which was comparable to that of standard (framycetin) in excision wound model( Sharma, 2010).

**Antioxidant activity**

The crude extracts and fractions of *B. variegate* were evaluated for their antioxidant potential. The antioxidant activity was performed by DPPH radical scavenging assay. Generally the lowest antioxidant activity was found in chloroform fraction. The ethyl acetate, methanol and *n*-hexane fractions showed moderate scavenging activity as compared to standard querceitin (Uddin *et.al.,* 2012).The ethanolic and aqueous extracts of the stem bark and root of *B. variegata* L. (Rajani and Ashok , 2009).

**Anti-cancer activity**

The ethanolic extract of *B. variegata* possessed antitumor effect in Dalton’s ascitic lymphomas ; it was also protected liver from the cytotoxic effect of diethyl nitrosamine. The ethanolic extract was also showed cytotoxicity on EAC mouse cell lines. It was effective in decreasing the rate of tumor incidence and the cumulative number of papillomas. Tumor yield and tumor burden were also found to be reduced. The depleted level of glutathione was restored in *B. variegata* bark extract treated (Rajkapoor *et.al.,* 2003).Ethanolic extract of the stem of *B. variegata* showed chemoprevention and cytotoxic effect against N- nitrosodiethylamine induced experimental liver tumor in rats at a dose of 200mg/kg, and also on human cancer cell lines. (Sonam Agarwal, 2009).

**Antidiabetic activity**

Insulin like sequences including domain structures occur in plant species also. This could give a biological basis for the effectiveness of plant extracts and decoctions in the management of hyperglycemia. Oral administration of ethanolic, aqueous and hydro-alcoholic extract of leaves and stem bark of *Bauhinia variegate* at different doses i.e 200 and 400 mg/kg in streptozotocin (STZ) and alloxan-induced diabetic rats reduced the elevated blood glucose level by increasing glucose metabolism..(Azevado *et.al.,* 2006). The hypoglycemic activity may be ascribed to the presence of flavonoids, which have been shown to inhibit cyclooxygenase and promote β-cell regeneration besides having insulin secretary property. (Ojha *et.al.,* 1995).

**Antimicrobial effects**

The antibacterial (against *Escherichia coli* MTCC 64, *Enterobacter aerogenes* MTCC 111, *Klebsiella pneumoniae* MTCC 39, *Pseudomonas aeruginosa* MTCC 424, *Salmonella typhi*, *Bacillus subtilis* MTCC 121) , of the ethanolic extracts of *Bauhinia variegata* were investigated in vitro . It appeared that the extracts were more effective against gram positive compared to gram negative bacteria (Kanak *et.al.,* 2012).

The extracts of *B. variegata* and fractions were evaluated for their antibacterial potential against selected bacterial strain (*Staphylococcus aureus, Bacillus subtilis* and *Klebsiella pneumonia*). The chloroform and methanolic fractions of *B.variegata* were found to be active against *Staphylococcus aureus, Klebsiella. pneumonia, Bacillus subtilis* and showed high inhibitory zone of (14 nm) at the concentration of 22 mg/ml(15nm) ( Sahu G and Gupta PK, 2012) Ethanolic extract of the stem bark of *B. variegata* exerted antimicrobial activity against *B. subtilis, P. aeruginosa, S. typhi, S. dysenteriae, S. aureus and Vibrio cholerae*. (RN Sharma, 1996). It was more effective against gram positive than gram negative bacteria. Methanolic extracts of leaves of *Bauhinia variegata* also showed antifungal against *Aspergillus niger* (Jigna *et.al.,* 2006).

**Phytochemical analysis**

**Phytochemicals from different Parts of *Bauhinia variegata***

Plant polyphenols act as strong antioxidants and they protect cell constituents against oxidative damage, thus averting the deleterious effects on nucleic acids, proteins and lipids in cells 5 (Dhale , 2011). High antioxidant capacities are observed in plants with high level of phenolic compounds (Rajani, 2009). These findings indicate that free radical scavenging in part has immense value in the prevention and treatment of deadly diseases and holds good only if the plant contains phenolics in considerable amount so that the plant can be commercially exploited. (Sharma *et.al.,* 1968).

**(a) (b)(c) )d)(e) (f)**

**Fig.** Showing **(a)** Root and Root bark, **(b)** Leaf, **(c)** Bud, **(d)** Stem and Stem Bark, **(e)** Flower and **(f)** Seeds of *Bauhinia variegate*

**Root bark and root**

Phytochemical analysis of the root bark of Bauhinia *variegata* yielded a new flavanone, (2S)-5, 7- dimethoxy-3, 4- methylene dioxy flavanone and a new dihydrodibenzoxepin, 5, 6 - dihydro - 1, 7 - dihydroxy - 3, 4 - dimethoxy 2 methyldibenzoxepin. The structures of the new compounds were determined on the basis of spectral studies. (Mopuru *et.al.,* 2003).

**Leaves**

Two new long chain compounds, heptatriacontan- 12, 13-diol and dotetracont-15-en-9-ol have been isolated from the leaves of *Bauhinia variegata*. Structures of these compounds have been elucidated by spectral data analysis and chemical studies. The leaves were also found to contain crude protein, calcium and phosphorous. Leaves of this plant were also reported to contain volatile oil (Singh *et.al.,* 2006). Leaves have flavonoids like quercetin, rutin, kaempferol. It is scientifically proved that flavonoids have significant effects on blood glucose level. It is used in phytomedicine in treatment of type I diabetes ( Patel *et.al.,* 2011). Diabetes mellitus is a heterogeneous metabolic or endocrine disorder characterized by hyperglycemia, glycosuruia and negative nitrogen balance leading to a number of microvascular (retinopathy, neuropathy & nephropathy) and macrovascular (heart attack, stroke and disease) diseases. Evidence based on immunological cross-reactivity and anti-diabetic properties has suggested the presence of insulin-like peptides in plants (C. R. Azevedo *et.al.,* 2006).

 Immunolocalization of the insulin-like protein in the leaves of *Bauhinia variegata* was performed by transmission electronmicroscopy using a polyclonal anti-insulin human antibody. The presence of an insulin-like protein in chloroplasts may indicate its involvement in carbohydrate metabolism.(Singh *et.al.,* 2006)).

**Buds**

Keto acids of flowering buds were analyzed during their development and correlated with the freeamino acids and amides. Phosphoenolpyruvic acid, oxaloacetic acid and α-ketoglutaric acid appeared in later stages. (D. Mukherjee, 1977).

**Stem bark and stem**

The stem bark showed presence of hentriacontane, octacosanol, stigmasterol and of sterols,glycosides, reducing sugars and nitrogenous substances on preliminary phytochemical screening. The stem yielded a flavonone glycoside characterized as 5, 7-dihydroxyflavonone-4–o-α-L–rhanmopyranosyl- β–D glucopyranoside (Prakash A and Khosla, 1978). The isolation of β-sitosterol, lupeol, kaempferol-3-glucoside and a 5, 7-dimethoxyflavonone-4–o-α–L–rhamnopyranosyl-β-D glucopyranoside was also reported from the stem of the plant . A flavonol glycoside, characterized as kaempferol-3- glucoside, was isolated from stem of this plant .(Reetika et.al, 2013) . on the basis of spectroscopic analysis additionally 5, 7-dihydroxy flavanone - 4'-O-a- L-rhamnopyranosyl b-D- glucopyranoside 5, 7 - dihydroxy and 5,7 dimethoxy flavanone-4-O-a-L-rhamnopyranosyl-b-D glucopyranosides hentriacontane, octacosanol, sitosterol, stigmasterol , neringenin-5,7-dimethylether-4'- rhamnoglucoside and lupeol were isolated. 5,7,3',4'-Tetrahydroxy-3-methoxy-7-O-alpha-Lrhamnopyranosyl- O-beta-galactopyranoside , 2,7-dimethoxy-3-methyl-9,l0 dihydrophenanthrene -l,4-dione named as bauhinione were isolated **(** Duret, 1977).

**Flower**

The phytoconstituents isolated from flowers of this plant *Bauhinia variegata* are as follows: Quercitroside. Isoquercitroside, rutoside, taxifoline rhamnoside, kaempferol-3-glucoside, myricetol glycoside , apigenin, ascorbic, aspartic, glutamic, octadecanoic acid, keto acids, amino acid, tannins , cyaniding-3-glucoside, malvidin-3-glucoside, malvidin-3-diglucoside, peonidin-3- glucoside, peonidin-3-diglucoside, 3-galactoside and 3-rhamnoglucoside of kaempferol (Saleh and Ishak, 1976).

**Seeds**

The seeds contains carbohydrates, proteins, amino acids, ascorbic acid, flavonoids, alkaloids, leucoanthocyanines , aspartic acid, glutamic acid, arginine, glycine, alanine, histidine, isoleucine, lysine, methionine, phenylalanine, proline, serine, threonine, tyrosine, valine .and 5-hydroxy7,3',4',5'-tetra-methoxyflavone5-O-beta-D-xylopyranosyl-alpha-L-rhamnopyranoside (Yadava and Reddy, 2001).

**SDS polyacrylamide gel electrophoresis (SDS-PAGE) for protein profiling of seeds of *Bauhinia variegata***

The seed storage protein analysis helps in identification and characterization of diversity in crop varieties, cultivars ad their wild varieties.Since many species are genetically closely related, it is often difficult to morphologically discriminate differences among species. Currently, biochemical methods especially SDS-PAGE is widely used in studies on phenotypically close taxa because SDS-PAGE of seed protein is a simple and effective method which is used as genetic markers in the study of genetic variation.

In study of *Sinha et.al.,* 2012, seed storage Protein profiles of five *Bauhinia* species were analysed by sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE). 10% SDS Polyarylamide gels showed variations in their banding pattern. Results of SDS-PAGE pattern of a few protein bands were up regulated whereas some other bands showed down regulation. Beside the common bands among the studied taxa, 7.37 kDa, 31.85 kDa and 261.143 kDa protein were found common in all the species. The maximum genetic affinities has been observed between *B. acuminata ,B. purpurea*, while minimum between *B. racemosa* and *B. variegata*.A new galactose-specific lectin was purified from seeds of a Caesalpinoideae plant, *Bauhinia variegata*, by affinity chromatography on lactose-agarose. SDS-PAGE showed that the lectin, named BVL, has a pattern similar to other lectins isolated from the same genus, *Bauhinia purpurea* (Debray *et.al.,*2008).

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