



ORIGINAL RESEARCH PAPER

Pharmacology

REVIEW ON BAUHINIA ACUMINATA

KEY WORDS: Bauhinia Acuminata, Pharmacognosy, Phytochemicals, And Pharmacology.

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ABSTRACT

Bauhinia species including (Bauhinia acuminata, Bauhinia variegata, Bauhinia purpurea, Bauhinia monandra, Bauhinia galpini) are popular ornamental plants usually woody ornamentals or herbaceous plants with attractive flowers typical of the leguminosae of arid temp. Sub – tropical and tropical zones. Bauhinia species are also have many multiple medicinal and biological properties. Phytochemical screening of two species viz. Bauhinia acuminata and cassia occidentalis belonging to family caesalpiniaceae was performed using generally accepted laboratory technique. Three solvent viz. chloroform, Benzene, and petroleum ether were used for extraction. The constituents were alkaloids, flavonoids, glycosides, saponin, steroids, and tannin. The distribution of these constituents in the leaves of selected species were assessed and compared. Preliminary phytochemical screening of Bauhinia acuminata did not reveal alkaloids. Glycoside, steroid, and flavonoids were present in both of species. Tannin was present in Cassia occidentalis while absent in Bauhinia acuminata. Saponin was absent in Cassia occidentalis while present in Bauhinia acuminata. The extraction of leave of Bauhinia acuminata and its kupchan fraction were screened for antioxidant, cytotoxic, membrane stabilizing, hemolytic and antimicrobial activity.

INTRODUCTION:

Medicinal plants are nature's priceless gift to human. Plant material have been used for the treatment of serious diseases throughout the world before the advent of modern clinical drug. The use of medicinal plants still plays an important role to cover the basic health need in the developing countries. Medicinal plants used for centuries as remedies for human diseases because they contain natural compound which play a dominant role in the development of novel drug lead for treatment and prevention of diseases.^[1-2]

The medicinal value of plants lies in some chemical substance or group of compound that produce a definite physiological action in the human body. These chemical substance are called secondary metabolite. The most important of these bioactive group of plants are alkaloids, terpenoids, steroids, flavonoids, tannins and phenolic compounds. [3] These bioactive substances are found to be distributed in plants yet these compounds were not established due to lack of knowledge and technique. [4] In recent years secondary metabolites with unknown pharmacological activities have been extensively investigated as a source of medicinal agent. [5] Flavonoids and phenols are strong antioxidants and have an important role in the health care system. [6] Screening of active compound from plants has led to the discovery of new medicinal drug which have efficient protection and treatment roles against various diseases including cancer and Alzheimer's diseases. [7] Screening of various natural organic

compounds and identifying active agents is the need of the hour, because successfully prediction of drug like properties at the onset of drug discovery will pay off later in drug development. The family Casalpiniaceas is extremely rich in flavonoids. Kampferol and Quercetin have been reported from flavonol group while Apigenin and Luteolin from flavones group in the members of this family. [8-9] Flavonoides are known antioxidant, of which Quercetin is a potent antioxidant. The seeds storage protein analysis helps in identification and characterization of diversity in crop varieties and also provides information on phylogenetic relationship of the accession. [10-11] the aim of the present study were to evaluate the chemical constituents of Bauhinia acuminata and Cassia occidentalis species of family Caesalpiniaceae. These species have been of keen interest in phytochemical and pharmacological research due to their excellent medicinal values. They are well known in folk medicine for their laxative and purgative uses. [12] Bauhinia acuminata leaves have antidiabetic action [13] and Cassia occidentalis is a medicinal herb found to have many disease preventive properties. [14] Hence the present study was carried out to evaluate the phytochemical constituents of Bauhinia acuminata leaf.

PLANT PROFILE:

The genus Bauhinia, one of the largest genera in sub – family caesalpiniaceae represent more than 300 species.^[15] Bauhinia

has been extensively planted as a garden, park and roadside ornamental tree in many warm temperate and sub – tropical region. [16] Bauhinia is also known as Mountain ebony. The term Bauhinia is derived from the new Latin word „Bauhin“. The synonym of Bauhinia is „dwarf white orchid tree“. The gene was named after the Bauhin brothers. Swiss - French botanists: Jean Bauhin (1541 – 1612) and Gaspard Bauhin (1560 – 1624). [17] Many species are widely planted in the tropics as ornamental, particularly in northern India, Vietnam and southeastern China.

Many species cultivars, and varieties are available. *Bauhinia acuminata* L. is seedless and would not present such a litter problem. It is the most spectacular and most wanted *Bauhinia* spp; bearing six – inch, orchid – like flowers of rich redish rose purple during the winter but is very tender to freezing temperatures. *Bauhinia variegata*, most popular, produces in winter and spring most nearly orchid – like blossoms of purplish casts or pure white in cultivar „Candida“. *Bauhinia purpurea*, most variable, produces narrow - petaled, red – purple to blue – purple flowers in late fall and early winter while leaves are on the trees. *Bauhinia monandra* produces pink, single - stamened flowers all summer. *Bauhinia acuminata* also blooms all summer but with white flowers. [18]

BAUHINIA ACUMINATA:

Dwraf white orchid tree Native: Asia Family: Caesalpiniaceae Height:2-3 m Leaf shape: Bilobed.

BAUHINIA ACUMINATA:

PLANT PROFILE

SCIENTIFIC CLASSIFICATION:

Kingdom: Plantae

Division: Angiosperms

Class: Eudicots.

Order: Fabales.

Family: Fabaceae or Leguminosae

Subfamily: Cercidoideae.

Genus: *Bauhinia*

Species: *B. acuminata*

Dwraf white orchid tree

Native :Asia

Height :2-3 m

Leaf shape :Bilobed



VERNACULAR NAME

English : Mountain ebony Hindi : Safedkachnar Tamil :Vellai mandaarai

Manipuri :Chingthraoangouba Malayalam :Mandaoram

Kannade :Kanchan

Assamese :Mati –katota Sanskrit :Sivamai

GEOGRAPHICAL DISTRIBUTION:

Bauhinia acuminata It is widely cultivated throughout the tropics as an ornamental plant. It may be found as an escape from cultivation in some areas, and has become naturalised on the Cape York Peninsula, Australia. This species occurs widely in deciduous forests and scrub.

MACROSCOPY

It is a cultivated shrub of 3 m tall; young stems, petioles and inflorescence axes sparse curled pubescence. Stipules lance – linear, 5 – 12 mm long acuminate, curled puberulent, caducous; largest collector swollen, divergent, 1.5 – 2.1 mm

long. Leaves with petioles 1.5 -4 cm long; blades ovate, broadly ovate or suborbicular, 5.4 – 11.3(20)x3.7-11.3 cm, divided about 1/3 their length, membranous, glabrous adaxially, densely puberulentabaxially, base cordate to rounded, apex of lobes acute. Inflorescence axillary racemes, 2.5 -5.8 cm long; peduncles negligible; bracts and bracteoles lance – linear, 3 – 9 mm long, puberulent, especially on margins, caducous. Flowers with pedicel 6 – 12 mm long; hypanthium 5 – 9 mm long; calyx limb spatheaceous, 28 – 37 mm long, with few scattered hairs abaxially, apex of 5 spirey lobes 1.7 – 4.1 mm long ; petals not clawed, elliptic to oblanceolate, 39 – 40 (60) x 20 – 25 (30) mm, glabrous, white; fertile stamens 10, filaments strigose at base; ovary stipitate, strigose on sutures, stigma peltate, bilobed . Legmumes linear, 7.5 – 15 x 1.7 – 1.8 cm, glabrous, brown; seeds suborbicular, ca. 10 mm diameter.[19,20,21] *Bauhinia* is grown in the best sunlight or high, shifting pine shade and it thrives in any well – drained soil but in alkaline soils and micronutrient deficiency can show interveinal chlorosis (yellowing) on the leaves . The wood tends to be weak and sprouts are often seen growing from the base of the tree creating an unkempt appearance. Besides this the fallen leaves messy because they are large and decompose slowly. Chewing insects and borers may present and this can creat problem for *Bauhinia*. Because of over – watering because it may tend to turn the foliage yellow.[22,23]

LEAF:

Leaves are Bilobed, shaped like an ox or cow hoof; long and broad with the apical cleft.

FLOWER:

Flowers are fragrant with five white petals, ten yellow tipped stamens and a green stigma.

FRUIT:

Fruit is a pod 7.5 to 15 cm long and 1.5 to 1.8 cm broad. [24]

CHEMICAL CONSTITUENT AND PHYTOCHEMICAL ACTIVITY OF BAUHINIA ACUMINATA:

Bauhinia acuminata is a species of flowering shrub native to tropical southeastern Asia. The leaves, bark, root, flowers, and seed, of this plant are used in traditional medicine. It is employed in the treatment of glandular swelling, skin diseases and ulcer. The chemical constituents found in *Bauhinia acuminata* were vitamin C (leaves), beta -sitosterol, lupeol, Kampferol, 3, 5, 7 – dehydroxy – and 5, 7 dimethoxy – flavanone – 4 – O – alpha – L – rhamnopyranosyl – beta – D – glucopyranosides. In *Bauhinia acuminata* flavonoids showed presence of kameferol, Quercetin, and Apigenin. Kamepfrol, Quercetin, and Apigenin were present in both the species. Derivatives of Quercetin i.e. Quercetin – 3 – glycoside was present in *Bauhinia acuminata* while Quercetin – 7 – glycoside was in *Cassia occidentalis*. [25] Several chemical compound including palmitic acid, three phthalic acid esters, phthalic acid, gallic acid, ursolic acid, were identified from the leaves of *Bauhinia acuminata*. [26] Phytochemical screening showed the presence of carbohydrate, phenolic compounds, saponins, flavonoids, oils and fats in leaves and stems of *Bauhinia acuminata*. Antioxidant potential activity is mainly due to their phenolic compounds.[27] The plant contain crude protein 23%, crude fiber 20.8%, lipid 24.9%, and carbohydrate 48%. [28] The phytochemical analysis showed that the different part of plant contain different chemical group included alkaloids, anthocyanoside, phenolics, proteins, phlobatannins, steroids, tannins, flavonoids, anthraquinone, saponins, terpenoids, resins, balsams, amino acid, carbohydrate, sugars and cardiac glycosides. [29,30]

TRADITIONAL USES:

Acuminata is a species of flowering shrub native to tropical southeastern Asia. The bark , flower, and root of the *Bauhinia acuminata* are used for various skin diseases, worms, tumours , and diabetes. [31] The bark and leaves of *Bauhinia acuminata*

is used to treat biliousness[32] is a remedy recommended by the Indian vaiydas.[33] In Malaysia and Indonesia the plant is used in the treatment of common cold and cough.[32] While in India the leaves and bark of this plant are used for treating asthma.[33] Moreover, the leaf of *Bauhinia acuminata* is used to treat bladder stone, venereal diseases, leprosy, asthma and digestive diseases.[34] Though different part of this plant were reported to good medicinal properties.[35] Defferent part of this plant such as bark, leaves, stem, flowers and roots have been used in traditional medicine.[36] Leaves were used externally and internally in skin disease scabies and The paste of leaves was externally applied to wounds, sores, itch, cutaneous disease, bone fracture, fever, ringworm, skin disease, throat infection, and to cure sore eyes. The leaves/root were ingredient of many popular herbal liver tonic and medicines for liver disorders. People use it also for the treatment of insect bites, snake bite, scorpion sting, constipation, oedema, fever, inflammation, rheumatism.[39] It roots, leaves, flowers and seeds were used as laxative and purgative.[40] The plant was also used as febrifuge, vermifuge, anticonvulsant and against chicken pox, guinea worm and black quarter.[41,42]

PHARMACOLOGICAL ACTIVITIES

1. ANTIBACTERIAL ACTIVITY

The antibacterial activity of the hexane, methanol, chloroform and water extract of *Bauhinia acuminata* and *Cassia occidanitails* was tested against *E. coli*, *P. multocida*, *S. typhi*, *S. typhimurim*, *S. pyogenes*, *S. pneumonia*, and *K. pneumonia*. The result showed that *E. coli* was the most susceptible microorganism.[43] Antibacterial activity of *Bauhinia acuminata* flower extract was evaluated against *Klebsiella pneumonia*, *Staphylococcus aureus*, *Streptococcus pneumonia* and *Pseudomonas aeruginosa*. The result showed that all the extracts had activity against *Klebsiella pneumonia* at a concentration between 30 – 90 mg/ml. The minimum inhibitory concentration ranged between 35 – 55 mg/ml for water extract and 25 – 55 mg/ml for chloroform extract. The minimum bactericidal concentration was 55 mg/ml by both water and chloroform extract.[44] Antibacterial activity of various extract of *Bauhinia acuminata* seeds was evaluated against three respiratory tract pathogens (*Staphylococcus aureus* MTCC 1144, *Streptococcus pneumonia* MTCC 655, *Streptococcus pyogenes* MTCC 442). The result showed that methanol extract was active antibacterial other than extract. The zone of inhibition exhibited by methanol extract against tested microorganism.[45,46,47]

2. ANTIBACTERIAL ACTIVITY:

The aqueous and ethanolic extracts of *B. variegata* L. have shown significant antioxidant activity. The % free radical scavenging activity gradually increases with increasing concentrations of *B. variegata* extracts in DPPH radical scavenging assay. Dose dependent antioxidant activity pattern was also observed in phosphomolybdate assay. Antioxidant activity was directly correlated with the amount of total phenolic contents in the extracts. *B. variegata* in L-dopa extract has shown the highest FRAP values.

3. ANTIBACTERIAL ACTIVITY

A new triterpene saponin, named as 23-hydroxy-3 α -[O- α -L-1C4-rhamnopyranosyl-(1" g 4')-O- α -L-4C1-arabinopyranosyl-oxyl]olean12-en-28-oic acid O- α -L-1C4-rhamnopyranosyl-(1" g 4")-O- β -D-4C1-glucopyranosyl-(1" g 6")-O- β -D-4C1-glucopyranosyl ester, isolated from the leaves, was found nontoxic (LD50) and to have significant anti-inflammatory activity.[55] It also showed antinociceptive effects that are more potent than the reference drugs. The mechanism responsible for the antinociceptive action of the extract is partly related to the modulated release or action of proinflammatory mediators involved in the models of pain used. It also showed a slight antischistosomal activity. A novel flavonol glycoside, 5,7,3',4'-

tetrahydroxy-3-methoxy-7-O- α -L-rhamnopyranosyl(1g 3)-O- β -D-galactopyranoside (5), molecular formula C₂₈H₃₂O₁₆, isolated from ethyl acetate soluble fraction of the 90% ethanolic extract of the roots of *B. variegata* showed marked anti-inflammatory activity as tested by carrageenan induced hind paw oedema method.[104] In the continuing search for novel anti-inflammatory agents, six Flavanoids namely, kaempferol (6), ombuin (7), kaempferol 7,4'-dimethylether 3-O- β -D-glucopyranoside (8), kaempferol 3-O- β -D-glucopyranoside (9), isorhamnetin 3-O- β -D-glucopyranoside (10) and hesperidin (11), together with one triterpenecaffeate, 3 β -trans-(3,4-dihydroxycinnamoyloxy) olean12-en-28-oic acid (12) were isolated from the non-woody aerial parts of *B. variegata*. Compounds 6-12 were evaluated as inhibitors of some macrophage functions involved in the inflammatory process. These seven compounds significantly and dose dependently inhibited lipopolysaccharide (LPS) and interferon (IFN)- γ induced nitric oxide (NO), and cytokines (tumour necrosis factor (TNF)- α and interleukin (IL)-12. [48]

4. ANTICARCINOGENIC & ANTIMUTAGENIC:

Anticarcinogenic and antimutagenic potential of *B. variegata* extract was evaluated in Swiss albino mice using a skin carcinogenesis and melanoma tumour model, along with micronucleus and chromosomal aberration tests. In the skin papilloma model, significant prevention, with delayed appearance and reduction in the cumulative no. of papillomas was observed in the DMBA + Kachanar + croton oil treated group as compared to the DMBA + Croton Oil group. C57 Bl mice which received a 50 % methanolic extract of Kachanar extract at the doses of 500 and 1,000 mg/kg body weight for 30 days showed increase in life span and tumour size was significantly reduced as compared to controls. In antimutagenicity studies, a single application of Kachanar extract at doses of 300, 600 and 900 mg/kg dry weight, 24 hours prior to the i.p. administration of cyclophosphamide (at 50 mg/kg) significantly prevented micronucleus formation and chromosomal aberrations in bone marrow cells of mice, in a dose dependent manner.[49]

In another study, ethanol extract of *B. variegata* (EBV) was evaluated against Dalton's ascitic lymphoma (DAL) in Swiss albino mice. EBV treatment was found to enhance peritoneal cell counts, probably mediated through enhancement and activation through macrophage or through some cytokine production inside the peritoneal cavity produced by EBV treatment. EBV treated groups were able to reverse the changes in the hematological parameters consequent to tumour inoculation. Flavanoids which have been shown to possess antimutagenic and anticarcinogenic activity and lectins reported to produce structural variation of the cell envelope may account for this effect.[50] The chemo preventive and cytotoxic effect of EBV was evaluated in N-nitrosodiethylamine (DEN, 200mg/kg) induced experimental liver tumour in rats and human cancer cell lines. EBV was found to be cytotoxic against human epithelial larynx cancer (Hep2) and human breast cancer (HBL-100) cells.[51]

5. ANTIMICROBIAL

B. variegata collected from Nepal was found to have antimicrobial activity against *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Shigella dysenteriae*, *S. aureus* and *Vibrio cholerae*. The same plant, collected in India, showed remarkable activity against gram +ve and gram -ve bacteria, being more effective against gram +ve bacteria. [52] The largest zone of inhibition was found to be exhibited against *B. subtilis*. In disc diffusion assays several solvent extracts of *B. variegata* inhibited the growth of *Staphylococcus aureus*. [53]

6. ANTIHYPERLIPIDEMIC:

Lipids are one of the most susceptible targets of free radicals.

This oxidative destruction is known as lipid peroxidation and may induce many pathological events. In the preliminary studies, it was found out that the aqueous and ethanolic extracts of *B. variegata* Linn. Have shown promising antihyperlipidemic activity.[54] It may partly owe its antihyperlipidemic activity to its antioxidant activity. A study on antihyperlipidemic activity of butanolic fraction of total methanol extract of leaves against Triton WR1339 induced hyperlipidemia in rats showed not only significant reduction in cholesterol, triglyceride, LDL, VLDL level, but also an increase in HDL level.[55]

7. HEPATOPROTECTIVE:

B. variegata alcoholic stem bark extract (SBE) exhibits significant hepatoprotective activity in CC14 intoxicated Sprague-Dawley rats. Hepatotoxins increase the levels of total lipids in liver. Total lipid content in serum and liver registered a significant hike, which was retrieved to near normalcy in SBE treated rats. This is the clear indication of the improvement of the functional integrity of the liver cells. CC14 impairs the capacity of the liver to synthesize albumin. So the protein content of serum decreases in such cases. Retrieval of protein concentration to normalcy further confirms *B. variegata* stem bark extract's hepatoprotective effect and its use as liver tonic.

8. INSULIN RELEASE ENHANCER:

The presence of insulin-like molecule was recently demonstrated in the leaves, where a 'chloroplast protein' was found that has a partial amino acid sequence identical to that of Bovine insulin. This protein may be responsible for the lowering of blood glucose concentration when it is injected in alloxan induced diabetic mice. A major metabolite of the ethanolic extract of leaves; roseoside, demonstrates insulinotropic activity toward pancreatic β-cells of the INS-1 cell line and may act in conjunction with the chloroplast protein to contribute to the overall antidiabetic properties.[59]

9. NEPHROPROTECTIVE:

The nephroprotective activity of the ethanolic extract of *Bauhinia variegata* (Linn.) whole stem against cisplatin-induced nephropathy was investigated by an in vivo method in rats. Treatment with the ethanol extract of BV at the dose level of 400 mg/kg b.w. for 14 days (EEBV400 group) significantly lowered the serum level of creatinine and urea, decreased urine creatinine and albumin with a significant weight gain, and increased urine output when compared with the toxic group. The histological damages in the BV extract-treated group were minimal in contrast to the toxic rats.[60]

CONCLUSION:

In this article, we had discussed that the relevant phytochemical, pharmacognostic, and pharmacological properties of *Bauhinia acuminata* and related species. The various phytochemical investigations has been revealed that flavonoids, glycosides, alkaloids, tannins, and terpenoids are present as active biological constituents which are responsible for different pharmacological action of *Bauhinia acuminata*. The present review revealed that *Bauhinia acuminata* possess various bioactive constituent and act as Antibacterial Activity , Antioxidant, Anti-Inflammatory , Nephroprotective, Proteinase Inhibitor, Insulin Release Enhancer, Hepatoprotective B, Hemagglutinator BVL, Antihyperlipidemic, Anticarcinogenic & Antimutagenic.

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