WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 1, 203-218. Review Article ISSN 2277– 7105

A REVIEW ON PHARMACOLOGICAL ACTIVITIES OF BAUHINIA VARIEGATA AND BAUHINIA PURPURAE

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Article Received on
12 Nov. 2020,

Revised on 02 Dec. 2020,
Accepted on 22 Dec. 2020

DOI: 10.20959/wjpr20211-19346

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ABSTRACT

The use of natural products as medicinal agents presumably predates the earliest recorded history. Bauhinia purpurea species of flowering plants is used in several traditional medicine systems to cure various diseases. These plant species 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 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 Bauhinia variagata and Bauhinia purpurea and its usage in different ailments.

KEYWORDS: Bauhinia variagata, Bauhinia purpurea, accepted species for medicinal uses, phytochemical, pharmacological activities.

I. INTRODUCTION

Bauhinia[1] is a large genus of flowering plants in the subfamily Cercidoideae[2] and tribe Bauhinieae[3] in the large flowering plant family Fabaceae, with a pantropical distribution. The genus was named after the Bauhin brothers Gaspard and Johann, Swiss-French botanists.

Many species are widely planted in the tropics as orchid trees, particularly in India, Sri Lanka, Vietnam and southeastern China. Other common names include mountain ebony and kachnar (India and Pakistan).

In the United States, the trees grow in Hawaii, coastal California, Texas, Louisiana, and Florida. Bauhinia and blakeana is the floral emblem of Hong Kong a stylized orchid tree flower appears on the flag of Hong Kong and Hong Kong Airlines uses 'Bauhinia' as its radio callsign in air traffic communication.

Scientific classification[4,5]

Kingdom: Plantae
Clade : Tracheophytes
Clade : Angiosperms
Clade : Eudicots
Clade : Rosids
Order : Fabales
Family : Fabaceae
Subfamily: Cercidoideae
Tribe : Bauhinieae
Genus : Bauhinia

Description

The genus Bauhinia, consisting of 300 species.[6] Bauhinia trees typically reach a height of 6–12 m and their branches spread 3–6 m outwards. The lobed leaves usually are 10–15 cm across.

The five-petaled flowers are 7.5–12.5 cm diameter, generally in shades of red, pink, purple, orange, or yellow, and are often fragrant. The tree begins flowering in late winter and often continues to flower into early summer. Depending on the species, Bauhinia flowers are usually in magenta, mauve, pink or white hues with crimson highlights.

Common names[7]

English : Butterfly Tree
Hindi : Kaniar
Kannada : Devakanchan

Marathi : Raktachandan

Tamil : Nilattiruvatti

Bengali : Koiral

Assamese: Og-yok

Cultivation

Propagation of Bauhinia species is from seeds or cuttings. They thrive in alkaline soils and do not tolerate salty conditions. Full sun exposure is preferred but they can be grown under partial sun. Generous watering is needed during summer, moderate moisture required in winter.

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.[7]
- Species of Bauhinia are rich in polyphenolics and are known for its medicinal properties.[8]
- 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.[9]
- The decoction of the flower is worked as a laxative.[6]
- Its traditional use to treat disease among to treat, ailments like glandular swellings, skin disease, ulcer, diarrhea, stomach tumor, and wounds.[7]

II. Phytochemicals in Bauhinia Variegate and Bauhinia purpurea flower.[12,13]

Name of the test	Results	
	Variegata	purpurea
Test for carbohydrate	+++	+++
Test for alkaloid	++	++
Test for steroid and sterol	+	++
Test for Glycoside	+++	+++
Test for saponin	+	++
Test for flavonoid	++	+++
Test for tannin and phenolic compound	+++	+++
Test for protein and amino acid	+	+
Test for fixed oil	+++	+++

III. Accepted species

Bauhinia acuminata[14] L.

Bauhinia bowkeri[16]

Bauhinia divaricata[17] L.

Bauhinia augusti[15]

Bauhinia flagelliflora[19]

Bauhinia forficate[19]

Bauhinia galpinii[20]

Bauhinia haughtii[21]

Bauhinia Integerrima Benth[22]



Bauhinia Mombassae Vatke[23], Bauhinia[24] Pink Orchid Tree, Bauhinia Petersiana Bolle[25]



Bauhinia pichinchensis Wunderlin[26], Bauhinia picta (Kunth) DC[27], Bauhinia racemosa lam[28]



Bauhinia rufescens Lam[29], Bauhinia seleriana Harms[30], Bauhinia tomentosa L.[33]

Bauhinia seminarioi Harms[31]

Bauhinia stenantha Diels[32]

Bauhinia ungulata l[34]

Bauhinia richardiana DC[36]

IV. Pharmacological activities

Bauhinia variegata

Hepatoprotective effect: The ethanolic concentrate of the stem of B. variegata demonstrated chemoprevention against N-nitrosodiethylamine prompted test liver tumor in rats. Ethanolic extricate smothered liver tumor incited by N nitrosodiethylamine as uncovered by reduction in N-nitrosodiethylamine initiated raised level of serum glutamate pyruvate transaminase, serum glutamate oxaloacetate transaminase, basic phosphatase, add up to bilirubin, gamma glutamate Trans peptidase, lipid peroxidase, glutathione peroxidase and glutathione-S-transferees. The ethanolic concentrate of the stem bark of B. variegata (at the dosage of 100 and 200 mg/kg orally) demonstrated Hepatoprotective movement against carbon tetrachloride incited hepatotoxicity in rats, it diminished the level of AST, ALT, ALP and GGTP.[35]

Effect on wound healing: Extraction and entry point twisted models in pale skinned person Wistar rats, were utilized to assess the injury recuperating movement of the ethanolic and fluid concentrates of foundation of Bauhinia variegata at measurements of 200 and 400 mg/kg bw. Both fluid and ethanolic concentrates of foundation of Bauhinia variegata at both measurements created noteworthy injury recuperating by extraction and cut injury models, which was equivalent to that of standard (framycetin) in extraction wound model.[36]

Anti-diabetic action: Oral organization of ethanolic, fluid and hydro-alcoholic concentrate of leaves and stem bark of Bauhinia variegata at various dosages i.e 200 and 400 mg/kg in streptozotocin (STZ) and alloxan-initiated diabetic rats lessened the raised blood glucose level by expanding glucose metabolism(reference: same as azevedo).[36]

Anti-helmintic activity: Watery and Chloroform concentrate of bark of B. variegata were examined for their hostile to helmintic action against Pheretima posthuma and Ascardia galli. All extricates displayed a measurements subordinate (25, 50what's more, 100 mg/ml) hindrance of unconstrained motility (loss of motion) and time of death of the worms. Remove gotten from bark not just murdered the Pheretima posthuma additionally murdered the Ascardia galli. The perceptions were tantamount with standard medication piperazine citrate at a centralization of 20 mg/ml and refined water as control. Most extreme vermicide action was appeared by both concentrate at the centralization of 100 mg/ml. From the test performed, it can be said that the watery and chloroform concentrate of bark of B. variegata bearing a potential anthelmintic action (reference same as bairagi).[37]

Anti-oxidant activity: An alternate some portion of B. variegata has been accounted for to contain quercetin, rutin, apigenin and epigenin 7-O-glucoside. Flavonoid and quercetin are powerful cancer prevention agents and known to balance the exercises of different protein frameworks due to their collaboration with biomolecules. Ethanolic and watery concentrates of B. variegata root created noteworthy cancer prevention agent action completed by in-vitro rummaging of free radicals utilizing 1, 2- diphenyl1-2-picrylhydrazyl (DPPH), nitric oxide and superoxide.[53] It might be the flavonoids and other phyto chemicals exhibit in the plant extracts. Ethanolic remove created essentially more prominent cell reinforcement movement than other extracts. In vitro cell reinforcement and free radical searching potential are of methanolic concentrates of B. variegata 50. Diverse parts of B. variegata like leaf, bark and blooms have free radical searching movement by hydroxyl radical searching technique. All concentrates have diverse level of cell reinforcement action. Among all concentrates methanol was found to be great dissolvable for extraction and having great cell reinforcement activity.[38]

Anti-ulcer activity: Ethanolic concentrate of stem bark of B. variegata demonstrates the counter ulcer movement against gastric ulcer prompted by pyloric ligation and ibuprofen instigated ulcer demonstrate in rats. Ethanolic extricate the volume of gastric discharge, add up to, free corrosiveness and ulcer record regarding control which increment amid ulcer.[39]

Anti-inflammatory effects: Phytochemical examination of non woody flying parts of Bauhinia variegata yielded 6 flavonoids with one triterpene caffeine. These seven mixes demonstrated calming action, they hindered the lipopolysaccharides and interferon γ prompted nitric oxide (NO) and cytokines.[40]

Anti-tubercular activity: The clinical reviews have uncovered that arrangement of stem bark of Bauhinia upgrade the impact of Anti – tubercular medications utilized as a part of instance of Tubercular Cervical Lymphadenitis.[41]

Anti-arthritic: Investigation of anti-arthritic activity of ethanolic extract of B. variegata by the oral administration of ethanolic extract at the tested dose level of 250 mg/kg on complete Freund's adjuvant (CFA) induced arthritis in rat for 15 days. At the end of 15 days, the rats were sacrificed, their blood was collected and then serum was separated. After that various parameters such as alanine amino transferase (ALT), alkaline phosphatase (ALP), total cholesterol and triglycerides were estimated. In the level of various antioxidant enzymes were

also evaluated in liver and kidney of normal, arthritic control and extract treated rats such as catalase, glutathione peroxidase (GPx), superoxide dismutase (SOD) and lipid peroxidase (LPO). The result of these studies shows that administration of this significantly Paw Edema volume in rat and altered the biochemical parameters and also level of various antioxidant enzymes which got affected in arthritic rats. From this study, it was concluded that the ethanolic extracts of this plant showed significant antiarthritic effect in rats.[42]

Nephroprotective: The nephroprotective movement of the ethanolic concentrate of Bauhinia variegata (Linn.) entire stem against cisplatin-prompted nephropathy was researched by an in vivo technique in rats. Treatment with the ethanol concentrate of Bauhinia variegata at the dose level of 400 mg/kg body weight for 14 days altogether limited the serum level of creatinine and urea, diminished pee creatinine and egg whites with a critical weight pick up, and expanded pee yield at the point when contrasted and the poisonous gathering. The histological harms in the Bauhinia variegata remove treated gathering were insignificant as opposed to the harmful rats.[42]

Bauhinia purpurae

Antimicrobial effect: The present study evaluated the development of the medicinal plant *B. purpurea* which exhibited antibacterial activities against two Gram-positive bacteria (*S. aureus* and *B. subtilis*). The findings are consistent with earlier reports in which *Bauhinia* species containing anthraquinone, flavonoids and polysaccharides that showed considerable activity against Gram-positive bacteria. The results are considered important since *S. aureus* is an important pathogen in man and animals and where resistance to other drugs is frequently reported. Methicillin resistant *S. aureus* is widely distributed among hospitals and increasingly isolated from community-acquired infections. It can be highlighted that the antimicrobial activity of *B. purpurea* leaf extract might be correlated to the presence of flavonoids and phenolic compounds. The mechanism of antimicrobial activity is complicated and could be attributed to synergism between flavonoids, hydroxy acids and sesquiterpenes . Flavonoids are the largest group of secondary metabolites in plants. Flavonoids exhibit antimicrobial activity through formation of a complex with the bacterial cell wall. They also possess antioxidant activity due to presence of a phenolic ring in the moiety.[44]

Antiulcer activity: The results of this study showed that the antioxidant activity, total phenolic, total flavonoid content were exhibited by the aqueous extracts of shade dried *Bauhinia purpurea* leaf, which might find its use in therapeutic applications. Since, the extract

used is aqueous extract, only water soluble phenolic compounds might have induced antioxidant activities. The screening of leaf extract for antioxidant activities reveal that it can be a potential source of natural antioxidant. Phenolic and polyphenolic compounds constitute the main class of natural antioxidants present in plants, foods, and beverages.[45] The literature reports showed that there is high correlation between antioxidant activity and phenolics content.[46] Antioxidants have been established to be the most effective way to eliminate adverse effects caused by free radicals as antioxidants can scavenge them or endorse their decomposition.[47] The use of plant extracts and phytochemicals with antioxidant activity can be of great significance in the treatment of many diseases.[48]

Antinociceptive, Analgesic and Antipyretic activity: The aqueous extract of leaf of *B. purpurea* possesses good antinociceptive, analgesic and antipyretic. The crude dried extract 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.[49]

It 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. The dose of 100 mg/kg was comparable with standard drugs. The ethyl acetate extract of stem bark of *Bauhinia purpurea* was found good analgesic activity tested at dose level 400 mg/kg by acetic acid induced writhing model and hot plate method.[50]

Cardiac activity: The cardiotonic activity of purified fraction-1 of ethanolic extract of stem of *B. purpurea* was studied and found that the fraction-1 has exhibited a 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.[51]

Hormone regulation: The aqueous alcoholic bark extract of *B. purpura* (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 by an increase in the activity of the antioxidant enzyme(s). Serum triiodothyronine (T3) and thyroxine (T4) concentrations were increased significantly by *Bauhinia Withania* could enhance only serum T4 concentration،[52]

Panda *et al.* (2003) studied the role of *Emblica Officinalis* L. and *Bauhinia purpurea* L. extracts in regulating thyroid functions were 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 oxidation.[53]

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 nitrogen.[54]

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. purpurae*. 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* has almost equal activity with *Aloe vera* in all four wound healing models.[55]

Anti-Diarrheal activity: The ethanolic extract of leaves shows an inhibitory effect at different dose level on animal models castor oil induced diarrhea in rats and gastrointestinal motility test by using the charcoal meal. These inhibitory effects support the use of the leaves

of *B. purpurea* in folklore medicine.[56]

Antibacterial and Anti-Fungal activity: The antimicrobial activity of leaf extract was determined in aqueous and organic extracts and the minimum inhibitory 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 the plant against the test microorganisms while less antibacterial activity was observed in hexane, acetone and aqueous extracts.[57]

Antioxidant activity: It explored as well as compared the antioxidant activity of the different plant parts of *B. purpurea* Linn, 1,1-diphenyl-2- picrylhydrazyl (DPPH) free radical scavenging and nitric oxide (NO) scavenging capacity were a 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.[58]

Antidiabetic activity: (A) It revealed that the bark of *Bauhinia purpurea* linn. was traditionally used as an astringent in diarrhea, the flower is 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 values.[59]

(B) The rat is showing blood glucose level 250-350 mg/dl were considered as a diabetic rat, induced by alloxan. The hypoglycemic activity of ethanolic extract and purified fraction-1 of the 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 cyclooxygenase and promote β-cell regeneration.[60]

Anti-inflammatory activity: It reviewed a large group of medicinal plants including B. purpurea which were used as traditional medicine and had the 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 edema, 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.[61]

CONCLUSION

The review research on *B. variegata* and *B. purpurea* suggested 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. variegata* and *B. purpurea* are dependent on geographical locations.

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

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