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Review Article

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PHYTOPHARMACOLOGICAL INSIGHTS INTO BAUHINIA PURPUREA: AN UPDATED COMPREHENSIVE REVIEW

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ABSTRACT

Bauhinia purpurea L., commonly known as the orchid tree, is a medicinally important member of the family Fabaceae and has been widely utilized in traditional medicine for the management of various ailments. This review summarizes the botanical characteristics, phytochemical composition, and pharmacological activities of *B. purpurea* reported up to 2026. The plant contains a diverse array of bioactive constituents, including carbohydrates, alkaloids, flavonoids, glycosides, tannins, phenolic compounds, steroids, sterols, saponins, proteins, amino acids, and fixed oils, which contribute to its broad therapeutic potential. Qualitative phytochemical screening indicates that leaves and flowers are particularly rich in carbohydrates, glycosides, tannins, phenolics, and fixed oils, while flowers exhibit comparatively higher flavonoid content. Pharmacological investigations have demonstrated a wide spectrum of biological activities, including antioxidant, anti-inflammatory, analgesic, antipyretic, antimicrobial, antidiarrheal, antidiabetic, antiulcer, hepatoprotective, nephroprotective, cardioprotective, cardiotonic, wound healing, antidepressant, antiepileptic, antiarthritic, anticancer, antitubercular, antimalarial, antifungal, anti-obesity, fibrinolytic, and antibiotic-potentiating effects. Most of these findings have been established through in vitro experiments and animal models using extracts from leaves, bark, roots, stems, flowers, and seeds. Despite encouraging preclinical evidence, clinical validation remains limited, and the molecular mechanisms responsible for many reported activities are not fully understood. Furthermore, studies on the flowers and isolated bioactive compounds remain comparatively scarce. Future research should prioritize bioactivity-guided isolation of phytoconstituents, mechanistic investigations, toxicological and pharmacokinetic evaluations, and well-designed clinical trials to establish the safety, efficacy, and therapeutic applicability of *B. purpurea* in evidence-based medicine.

Keywords: *Bauhinia purpurea*; Fabaceae; Phytochemicals; Pharmacological activities; Antioxidant activity; Medicinal plant.

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INTRODUCTION

Bauhinia purpurea, a flowering plant of the Fabaceae family, is native to the Indian subcontinent and Myanmar, and has been introduced to various other regions globally [1]. The genus name honors Swiss botanists Jean and Gaspard Bauhin, while the species name *purpurea* refers to the characteristic purple coloration of its flowers. Comprising approximately 300 species, the genus is predominantly distributed in tropical regions. *Bauhinia purpurea*, commonly known as the orchid tree or butterfly tree, is cultivated for its ornamental foliage and conspicuous flowers and occurs as trees, vines, or shrubs [2]. This species is a small to medium-sized tree, reaching heights of up to 5.2

meters (17 feet). The leaves are simple, alternate, and bi-lobed at the base, measuring 10–20 cm in length and breadth, with rounded bases and apices. The bark is pale grey-brown, exhibiting a texture that ranges from smooth to fissured and scaly. Young branches are glabrous, evolving from slender, light green, hairy, angled twigs to mature brownish-grey branches. The heartwood is brown, hard, and durable. The tree forms a round, symmetric, and moderately dense crown. Floral characteristics include terminal panicles bearing racemes of 6 to 10 flowers. Flowers exhibit five narrow pink petals with a club-shaped, turbinate hypanthium and emit a pronounced fragrance. They possess a superior ovary and contain three to four

velvety fertile stamens with versatile anthers constricted at the base, and the tubular calyx splits approximately 6 mm in length. The corolla is along one side upon full expansion. Flowering occurs from September to November, producing a visually striking display reminiscent of orchids.

The fruit is a dehiscent, elongated, flat, strap-shaped pod, slender and brown, containing 12 to 16 spherical seeds. Fruits develop throughout winter and mature in spring and summer. Notably, stomata are present on both seeds and pods [1, 2].

Taxonomy of *Bauhinia purpurea*

Kingdom: Plantae

Phylum: Spermatophyta

Subphylum: Angiospermae

Class: Dicotyledonae

Order: Fabales

Family: Fabaceae

Subfamily: Caesalpinioideae

Genus: *Bauhinia*

Species: *Bauhinia purpurea*

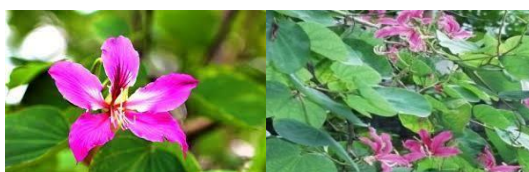


Figure 01:

Phytochemicals in *Bauhinia purpurea*

Table 01:

Name of The Test	Results of leaf [32]	Results of Flower [5]
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	+++	+++
Name of The Test	Results of leaf [32]	Results of Flower [5]
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	+++	+++

Pharmacological Profile of *Bauhinia purpurea* up To 2026

S.No	Pharmacological activity reported	Part used	Extract used	Description about Model/Organism/Celllines	Reported year
I.	Antidiarrheal [11]	Leaf	Ethanollic	Castor oil induced diarrhea and gastrointestinal motility test by using charcoalmeal	1998

2.	Amelioration of hyperthyroidism [8&9]	Leaf	Ethanollic	LT-induced hyperiod animals	2003& 2015
3.	Anti-oxidant [18 & 19]	Leaf	Aqueous	By nitric acids scavenging assay, reducing power method	2005& 2014
4.	Anti-cancer I [22]	Leaf	Methanolic	Inhibit P388 cancer cell line	2006
5.	Antinociceptive, Anti-inflammatory, Analgesic, Anti-Pyretic [14&15]	Leaf	Chloroform Aqueous	Formalin test, abdominal constriction and eddy's hot plate method and carrageenan induced paw edema method, brewer's yeast induced pyrexia test	2007& 2009
6.	Cardiotonic effect [30]	Stem	Ethanollic	Cardiotonic effect on isolated frog's heart	2008
7.	Cytotoxic [6&7]	Leaf	Dichloromethane	Brine shrimp lethality method of bioassay KB and BC cell lines	2007& 2013
8.	Nephroprotective [16]	Leaf	Ethanollic	Gentamicin induced Nephrotoxicity	2009
9.	Analgesic, Anti-inflammatory activity, anti-arthritis activity [4]	Stem	Ethanollic	Eddy hot plate method in rats and acetic acid induced abdominal writhing in mice for analgesic activity Carrageenan induced hind paw Edema method in rats and adjuvant induced arthritis models for anti-inflammatory and anti-arthritis activities	2009
10.	Wound healing [17]	Leaf	Methanolic and chloroform	Excision wound, burn, dead space wound and incision wound models	2010
11.	Anti-hyperlipidemic [21]	Leaf	Ethanollic	Induced with high fat diet	2010
12.	Anti-ulcer activity [33]	Leaf	Aqueous extract	Ethanol- and indomethacin-induced gastric ulcer, and pyloric ligation models	2011
13.	Anti-epileptic [12]	Leaf	Ethanollic	Using PTZ (pentylenetetrazole induced seizure) and MEZ (maximum electric shock) model	2011
14.	Anti-ulcer [20]		Methanolic	Inducing gastric ulcer with indomethacin, absolute ethanol and pylorus ligation	2012
15.	Anti-microbial [10] Antibacterial and Anti-fungal [24]	Leaf	Aqueous and organic	Against microorganisms <i>Bacillus subtilis</i> , <i>Staphylococcus aureus</i> , <i>Salmonella typhi</i> , <i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Candida albicans</i> using the disk diffusion method	2012
16.	Hepatoprotective [23]	Leaf	Methanolic	Induced by Oral administration of Paracetamol	2013
17.	Anti-microbial [29]	Stem bark	Methanolic Ethyl acetate Petroleum ether	Against <i>Salmonella typhi</i> & <i>Bacillus amyloliquefaciens</i>	2013
18.	Anti-diabetic [31]	Not mentioned	Petroleum ether Hexane	In-vitro methods like Non-Enzymatic Glycosylation of Hemoglobin Assay and Glucose uptake in yeast cells Alpha-Amylase inhibitory Assay	2013

19.	Anti-oxidant [27& 28]	Stem bark	Sequential extracts with various polarities of solvents	Free radical scavenging activity, Metal chelating activity, Superoxide anion scavenging assay Nitric oxide scavenging activity, Hydrogen peroxide scavenging activity	2013& 2015
20.	Anti-depressant [13]	Leaf	Ethanollic	Using forced swim test and tail suspension test	2017
21.	Anti-arthritis activity [37]	Bark	Hydroalcoholic extract	Adjuvant induced rat paw arthritis model	2019
22.	Cardiotonic activity [4]	Flowers	Flower fresh juice, alcoholic and chloroform extracts	produced positive inotropic effect against normal and hypodynamic frog heart	2020
23.	Anti-tubercular, Anti-malarial, Anti-fungal, cytotoxic activity Fibrinolytic activity Anti-obesity Laxative property [3]	Root Leaf Bark Flowers	Methanolic	Brine shrimp lethality method of bioassay, For anti-tubercular activity Alamar Blue assay method with the help of Mycobacterium tuberculosis H37Ra Intra-mammary inoculation of coagulase positive staphylococcus aureus in goats Hyperlipidemia induced by high fat diet in male wistar rats	2020
24.	Anti-cancer activity [36]	Seeds	Isolated phytoconstituent	MTT, lactate dehydrogenase (LDH) leakage, reactive oxygen species (ROS), and caspase- 3 assays in MCF-7 Breast cancer cell lines	2020
25.	Anti-nociceptive, Anti-inflammatory activity [4]	Root	Ethanollic	Tail flick Method and Acetic acid induced writhing methods for nociception Carrageenan induced paw edema model and cotton pellet Granuloma pouch method for anti-inflammatory activity	2020
26.	Anti-cancer activity [26]	Stem	Not mentioned	Inhibition of p388 cancer cell lines proliferation	2020
27.	Cardioprotective activity [39]	All aerial parts	Methanolic	Adrenaline-induced cardiotoxicity in rats	2022
28.	Hepatoprotective activity [35]	Leaf	Chloroform	Paracetamol (PCM)-induced liver injury (PILI) in rats	2023
29.	Wound healing in diabetics [38]	Bark with mixture of other herbal extract	Not mentioned	Streptozotocin induced diabetes and Staphylococcus aureus infected manual wound in rats	2023
30.	Antibiotic potentiating effect against clinical isolates of multidrug resistant Staphylococcus aureus [40]	Bark	Methanolic	Activity with penicillin, gentamicin, ciprofloxacin, and clindamycin against most of the tested isolates of multidrug-resistant Staphylococcus aureus (MDR-SA)	2024
31.	Therapeutic potential in hyperoxia-induced acute lung injury [34]	Leaf	Ethyl acetate	Mice were exposed to >95% O ₂ to induce Hyperoxia induced Acute Lung injury (Murine model)	2026

Bauhinia purpurea exhibits a diverse and extensive range of pharmacological activities validated across various biological systems. These therapeutic effects

are primarily attributed to the presence of a wide array of bioactive phytochemicals, including terpenoids, flavonoids, steroids, phenolics, and other secondary

metabolites distributed throughout different parts of the plant. The accumulated evidence underscores the plant's broad-spectrum therapeutic potential; however, the majority of this evidence is derived from preclinical investigations, including in vitro and animal studies. Only a limited number of these findings have progressed to clinical validation, indicating a substantial need for rigorous clinical trials to fully establish safety and efficacy in humans.

A critical analysis of the existing literature reveals several significant gaps and limitations. Firstly, the pharmacological properties of the flowers of *B. purpurea* have been comparatively underexplored relative to other plant parts such as leaves, bark, and roots. Secondly, most studies have concentrated on evaluating crude extracts, with relatively few investigations isolating and characterizing specific bioactive compounds responsible for the observed pharmacological effects. This limitation hampers the understanding of precise mechanisms of action and the development of targeted therapeutic agents. Furthermore, the majority of research has focused on describing pharmacological activities without delving into the molecular or biochemical pathways underlying these effects.

In addition, there is a notable deficiency in comprehensive toxicological, pharmacokinetic, and clinical data. Detailed toxicological assessments are crucial to ascertain the safety profile of *B. purpurea*, while pharmacokinetic studies would provide insights into absorption, distribution, metabolism, and excretion of its active constituents. The paucity of such data represents a critical barrier to advancing *B. purpurea* from experimental studies to clinical applications. Addressing these gaps through systematic and well-designed studies will be essential to harness the full medicinal potential of *Bauhinia purpurea* and facilitate its integration into evidence-based therapeutic practices.

CONCLUSION

Bauhinia purpurea represents a promising medicinal plant with diverse phytochemical constituents and extensive pharmacological properties supported by numerous preclinical studies. The available evidence highlights its potential in managing inflammatory disorders, infections, metabolic diseases, cardiovascular conditions, cancer, and tissue repair. However, the translation of these findings into clinical practice is constrained by limited human studies, insufficient mechanistic evidence, and inadequate toxicological and pharmacokinetic data. In addition, the flowers of *B. purpurea* remain relatively underexplored despite their rich phytochemical profile. Future investigations should focus on the isolation and characterization of active compounds, elucidation of molecular mechanisms, standardization of extracts, and comprehensive clinical evaluations. Addressing these research gaps will facilitate the development of safe, effective, and

evidence-based therapeutic agents derived from *Bauhinia purpurea*.

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