

Bauhinia Tomentosa L. From Botanical Beauty to Medical Marvel A Comprehensive Survey

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Abstract:- Herbal medications have gained popularity globally due to their increased bio-efficacy and relatively low adverse effects. The pharmacological properties and pharmacognostic traits of the Fabaceae family plant *Bauhinia tomentosa* Linn are investigated in this work. Broadly dispersed throughout Oceania, North America, Africa, and Asia. *Bauhinia tomentosa* L. is a little flowering tree with a variety of medicinal uses.

Pharmacological activities of *Bauhinia tomentosa* L. have a long list of known benefits, including wound healing, nephroprotective, anti-inflammatory, antibacterial, hepatoprotective, anti-cancer, diuretic, antioxidant, analgesic, anti-anxiety, anti-catatonic, anti-depressant, anti-diabetic, and anti-pyretic. Various animal models and assays have reported these activities.

The plant contains a wide variety of phytochemicals, such as acids, steroids, phenols, coumarins, alkaloids, cyanins, flavonoids, terpenoids, and triterpenoids. The presence of these bioactive compounds contributes to the diverse therapeutic potential of *Bauhinia tomentosa* L., making it a subject of interest for further exploration in drug development and complementary medicine.

Keywords:- *Bauhinia Tomentosa* L., Pharmacognostic, Nephroprotective, Phytochemicals, Pharmacological Activities, Bioactivities.

I. INTRODUCTION

Bauhinia tomentosa L. is a small tree in the Fabaceae family that grows to a height of 1 to 8 meters. It is also known as Thiruvaththi in Tamil. Native to Africa (Angola, Burundi, Ethiopia, Kenya, Malawi, Mozambique, Somalia, Sudan, Swaziland, South Africa, Tanzania, Zambia, and Zimbabwe), Asia (Andaman Islands, China, Malaysia, Taiwan, Thailand, and Vietnam), Africa (Cameroon, Gambia, Ghana, Guinea, Nigeria, and Sierra Leone), North America (Cuba, Dominican Republic, Haiti, Puerto Rico, and Trinidad and Tobago), and Oceania (Australia), it possesses natively to Asia (Sri Lanka, Yemen, and India) [1].

Traditional ethnomedicines in Asia and Africa use *Bauhinia tomentosa* to treat a wide range of conditions, such as inflammation of the liver, abscesses, tumors, wounds, hyperlipidemia, bleeding, diabetes, diarrhea, animal bites, helminthiasis, infections, fever, and illnesses of the abdomen, skin, and urinary tract [2][3][4][5]. In addition, the plant is grown as a hedge and an ornamental species in

gardens. The wood from its trees is used to make shed beams, and the fiber it produces is used to make baskets. In addition, the flowers are used in Saiva rituals in Sri Lanka, and the leaves are used to make a yellow dye [5].

The leaves of *B. tomentosa* have been found to contain a number of compounds, including Phytone, β -cubebene, β -caryophyllene, 3-O-methyl-d-glucose, phthalic acid, ethyl pentyl ester, 2-butanone, 3-methoxy-3-methyl, 2,2-dimethylpropionic acid, cyclopentyl ester, 2-hexen-1-ol, 2-ethyl, 5-hydroxy-2,2-dimethylhexan-3-one, pentanoic acid, 2-methyl, butane, and 1-bromo-2-methyl [6][7]. *B. tomentosa* has medicinal significance, but its pharmacognostic, phytochemical, and pharmacological aspects have not been thoroughly reviewed in a systematic manner. In order to provide important insights for upcoming research in these areas, this review attempts to assess, record, and summarize the current knowledge on the pharmacognostic, phytochemical, and pharmacological investigations of this plant species.

Utilizing electronic databases like the Web of Science, Scopus, PubMed, Google Scholar, and Science Direct, an extensive review of the literature covering studies published from 1900 to November 2023 was carried out in order to accomplish this goal. To find pertinent studies, the search term "*Bauhinia tomentosa*" was used. A table that presents the gathered data in an organized manner includes the level of scientific evidence, bioactivity, part used, extract/compound, and reference.

The focus of a significant number of studies was on investigating the antioxidant activities of *Bauhinia tomentosa* [8][9][10][11]. The leaves of this plant exhibited diverse bioactivities, encompassing antibacterial [12][13], anticonvulsant [14], anti-anxiety, anticatatonic, antidepressant [15], antidiabetic [16][17][18][10], anti-ulcerative colitis [19], motor coordination [15], nephroprotective [20], and nootropic [15] activities.

It is noteworthy that the ethanol extract was predominantly utilized in the reviewed studies, although no bioactive compound has been isolated from *Bauhinia tomentosa* to date. Despite its extensive use in ethnomedicines, the scientific evidence currently supports only specific ethnomedicinal treatments, such as those related to inflammation, infections, diabetes, helminthiasis, hyperlipidemia, hepatotoxicity, diuretic, anti-pyretic, nephrotoxicity, and wound healing activities. This comprehensive overview serves as a valuable resource for future research endeavors in the pharmacognostic,

phytochemical, and pharmacological exploration of Bauhinia tomentosa.

II. DESCRIPTION

Southeast Asian native Bauhinia tomentosa, also referred to as Yellow Orchid Tree or Yellow Bauhinia, is a tropical and subtropical flowering plant. This is how the plant is described:.

➤ Leaves:

Bauhinia tomentosa leaves are bilobed or "butterfly", the two lobes resemble butterfly wings. They are usually large, dark green and covered with fine hairs (tomentum), giving them a slightly fuzzy texture.

➤ Flowers:

The plant bears five-petaled, bright yellow flowers that resemble orchids. These flowers have a pleasant aroma and are typically 2-3 inches (5-7.5 cm) in diameter. There are clusters of flowers. Growth habit: The yellow bell orchid tree is a medium-sized shrub that can reach a height of 10-20 feet (3-6 meters). It has a tendency to spread and often grow a little or cry.

➤ Bark:

The bark of this species is usually smooth and grey-brown.

➤ Fruit:

The plant produces long, thin, woody pods that contain seeds. These pods can be 8-12 inches (20-30 cm) long.

III. HABITAT

Bauhinia is a tropical and subtropical plant found in a variety of habitats. It is indigenous to South Asia and distinguished by its bell-shaped, yellow flowers. This plant usually grows in the following habitats:

➤ Forest:

Occurs in open forest and deciduous forest, often in well-drained soil.

➤ Savanna:

Bauhinia tomentosa can also grow in a savanna-like ecosystem with a mixture of trees and grass. Roadsides and Disturbed Areas: Adapted and often found in disturbed areas such as roadsides and abandoned fields.

➤ Coastal areas:

In some areas, if conditions are favorable, they can be found along beaches and rivers Gardens and Cultivated.

➤ Areas:

Cultivated in gardens and parks in temperate climates for their attractive flowers. Prefers warm, tropical to subtropical climate and well-drained soil. Note that the exact location may vary depending on the region and local environmental conditions.

IV. CULTIVATION

Bauhinia tomentosa linn is a tropical plant that can be cultivated for ornamental and medicinal purposes. Here are some general guidelines for growing and harvesting.

➤ Geographical Conditions and Climate:

Tropical and subtropical areas are ideal for Bauhinia tomentosa growth. likes bright light or some shade.

➤ Soil Requirements:

Good growing soil is important for this plant. Soil pH is slightly acidic to neutral (about 6.0-7.5).

➤ Separate:

You can propagate Bauhinia tomentosa from seed or cuttings. The seeds must be crushed (apply a hard seed layer) before planting. Cuttings should be taken from semi-hardwood and treated with rooting hormone.

➤ Plants:

Plant seeds or cuttings in prepared soil and water well. Space plants at least a few meters apart to allow them to grow.

➤ Watering:

Keep the soil consistently moist, but not waterlogged, especially during the growing season.

➤ Nursery:

During the spring and summer growing season, apply a balanced, slow-release fertilizer.

➤ Tree:

Pruning as necessary to maintain the shape of the plant and remove dead or diseased branches.

➤ Pests and Diseases:

Beware of common pests such as aphids and scale insects. Fungal diseases can occur, so maintain good air circulation and avoid overwatering.

➤ Harvest:

Bauhinia tomentosa leaves are used in traditional medicine and can be harvested for their beautiful flowers. Flowers are usually collected for decoration during flowering.

➤ Drug Use:

Some traditional herbal practices use Bauhinia tomentosa for its potential medicinal properties, but it is important to consult a health professional before using any plant for medicinal purposes.

➤ Legal Considerations:

Be aware of local regulations regarding the collection and use of native plants.

➤ *Plant Profile*

- *Plant Name:*
Bauhinia Tomentosa Linn.



Fig 1 The Bauhinia Tomentosa L. Plant

• *Botanical Information*

- ✓ Kingdom: Plantae
- ✓ Phylum: Tracheophyta
- ✓ Class: Magnoliopsida
- ✓ Order: Fabales
- ✓ Family: Fabaceae
- ✓ Subfamily: Caesalpinioideae
- ✓ Genus: Bauhinia
- ✓ Species: Tomentosa
- ✓ Author: Carl Linnaeus (abbreviated as "L" for Linnaeus)
- ✓ Botanical name: *Bauhinia Tomentosa* Linn.

• *Common Names* ^[25]

- ✓ Hindi: Kachnar
- ✓ Bengali: Kanchan
- ✓ Unani: Kachnal
- ✓ Kannada: Devakanchan
- ✓ Marathi: Raktachanda
- ✓ Tamil: Nilattiruvatti
- ✓ English: Butterfly Tree

➤ *Morphology*

Bauhinia tomentosa L. is a tropical plant with a unique morphology that is also referred to as the Yellow Bell Orchid Tree. Here are some key features of its morphology:

➤ *Leaves:*

The most characteristic feature of this plant is its bilobed or butterfly-shaped leaves. Each leaf is divided into two lobes, giving it a unique appearance.

➤ *Flowers:*

Yellow Bell Orchid Tree produces bright yellow, bell-shaped flowers. These flowers are typically large and showy, with five petals and a pronounced tubular shape.

➤ *Fruit:*

The plant produces flattened, elongated seed pods, which are often woody and brown. The pods can be up to several inches long and contain seeds.

➤ *Bark:*

The bark of the Yellow Bell Orchid Tree is typically smooth and gray to brown in color.

➤ *Stem:*

The stems are often slender and green, with a tendency to climb or sprawl. Please note that the exact morphology of the plant can vary somewhat depending on its growth conditions and location, but these are the general characteristics of *Bauhinia tomentosa*.

V. MEDICINAL USES

It is known that tribes in India like Kathkor and Gonda consume the cooked small pods and mature seeds of the kachnar plant^[25] Species of *Beauhinia* are well-known for their medicinal qualities and for being rich in polyphenolics^[26] Its decoction is suggested as a practical boil-washing solution. Boils and blisters can be treated with a poultice made of bark, root, and flower mixture mixed with boiling rice water.^[27] A flower decoction has laxative properties.^[21] Traditional uses include the treatment of wounds, stomach tumors, diarrhea, ulcers, skin conditions, and gland inflammation.^[7]

VI. CHEMICAL CONSTITUENTS

Bauhinia tomentosa Linn possesses a diverse array of chemical constituents, contributing to its pharmacological properties. These include Flavonoids: A varied group of phytochemicals such as quercetin, kaempferol, and rutin.

➤ *Tannins:*

Fruits, leaves, bark, and other plant parts are frequently sources of tannins, which are bitter substances.

➤ *Alkaloids:*

Alkaloids are recognized for their wide range of bioactive characteristics, and certain *Bauhinia* species may contain them.

➤ *Saponins:*

Glycosides with foaming properties, potentially offering health benefits.

➤ *Terpenoids:*

Found in the essential oils of the plant, terpenoids may possess medicinal properties.

It is important to recognize that the specific phytochemical composition can vary based on the plant part (leaves, stem, flowers, etc.) and the growing conditions of the plant. Noteworthy chemical constituents in different parts of *Bauhinia tomentosa* include.

➤ *Flower:*

Flavonoids found in flowers include rutin (4.6%), isoquerlitrin (6%), and trace amounts of quercetrin. Lignins, saponins, sterols, alkaloids, and phenols are obtained from flower extract.

➤ *Seed:*

Provides protein, pentosan, water-soluble mucilage, saponins, and a fatty oil called ebony oil.

➤ *Bark:*

Produces fibers.

➤ *Roots:*

Proteins, flavonoids, carbohydrates, tannins, phenolic compounds, and steroids are all present in roots.^[28]

Phytochemical Screening of Crude Flower Extract:
Crude flower extract is screened phytochemically, which reveals the presence of fixed oils, carbohydrates, glycosides, alkaloids, phytosteroids, flavonoids, saponins, tannins, and phenolic compounds. It's crucial to emphasize that these chemical constituents contribute to the plant's therapeutic potential, and their concentrations can vary significantly depending on the specific plant part analyzed and the environmental conditions in which the plant grows.

Table 1 Physical Attributes of the Plant *Bauhinia Tomentosa* L. [30]

| Sr. No. | Physical Attributes | Percentage Value |
|---------|---------------------|------------------|
| 1. | Total value of ash | 5.73 |
| | Insoluble in Acid | 2.37 |
| | Soluble in Water | 3.75 |
| 2. | Swelling Index | 37.6 |
| 3. | Loss on drying | 8.45 |
| 4. | Foaming index | No foam |
| 5. | Value of Extraction | 5.28 |

Table 2 Phytochemicals Present in Plant *Bauhinia Tomentosa* Linn [29] .

| Sr. No. | Phytochemicals | Aqueous | Ethanol | Methanol | Chloroform | Petroleum ether |
|---------|--------------------|---------|---------|----------|------------|-----------------|
| 1 | Tannins | +++ | ++ | - | +++ | - |
| 2 | Saponin | +++ | - | +++ | - | ++ |
| 3 | Flavonoids | - | +++ | +++ | +++ | - |
| 4 | Alkaloids | - | ++ | +++ | +++ | + |
| 5 | Cyanins | +++ | +++ | +++ | +++ | +++ |
| 6 | Quinones | - | - | - | - | - |
| 7 | Glycosides | - | - | - | - | - |
| 8 | Cardiac glycosides | +++ | + | +++ | ++ | ++ |
| 9 | Terpenoids | +++ | +++ | - | +++ | - |
| 10 | Triterpenoids | - | ++ | - | ++ | - |
| 11 | Phenols | +++ | +++ | +++ | +++ | - |
| 12 | Coumarins | - | ++ | +++ | +++ | +++ |
| 13 | Acids | ++ | +++ | +++ | +++ | ++ |
| 14 | Proteins | - | - | - | - | - |
| 15 | Steroids | +++ | +++ | +++ | +++ | +++ |

VII. PHARMACOLOGICAL ACTIVITIES

Antibacterial Activity: Aqueous and ethanolic leaf extracts have been shown in vitro experiments to have strong antibacterial properties against a range of human pathogenic bacteria ^[31]. **Hepatoprotective Activity:** Bark extract in ethanolic form demonstrated dose-dependent protection against liver damage when given to albino wistar rats that had been exposed to CCl₄-induced hepatotoxicity ^[32]. **Anticancer Activity:** Anticancer activity was demonstrated by the methanolic leaf extract ^[29]. **Diuretic Activity:** Potential diuretic action was shown when wistar rats were given an ethanolic root extract orally ^[33]. **Antioxidant Activity:** When given orally to animal models of diabetes induced by streptozotocin, an ethanol extract of flowers demonstrated antioxidant activity ^[34]. **Analgesic Activity:** In the Eddy's hot plate method, mice given oral treatments with aqueous and methanol extracts of the root showed notable analgesic effects ^[10]. **Anti-anxiety Activity:** The administration of ethanol extract of leaves resulted in anti-anxiety activity as measured by the elevated

plus maze model, hole-board test, and light-dark model ^[15]. **Anticatatonic Activity:** Animal models of catalepsy induced by haloperidol responded favourably to an ethanolic leaf extract, demonstrating anticatatonic effects ^[15]. **Antidepressant Activity:** In a study by Sathya et al. (2011) ethanol extract of leaves was administered found that antidepressant activity was present and that the forced swim test and diazepam-induced sleeping time models had better conditions ^[15]. **Anti-diabetic Activity:** When streptozotocin-induced diabetic animals were given an oral flower ethanol extract, their blood glucose levels were significantly reduced ^{[16][17][18][35]}. **Anti-pyretic Activity:** After three hundred minutes, oral administration of methanolic extracts from the root and stem decreased hypothermia in yeast-induced hyperthermia models ^[36]. **Anti-ulcerative Colitis Activity:** Significant anti-ulcerative colitis effects were observed in animals with colonic inflammation when a 70 percent methanol extract of the leaves was given orally ^[19]. **Nephroprotective Activity:** Ethanolic extract from the aerial parts dramatically lowered serum biomarker levels and decreased renal lipid peroxidation in Wistar male albino

rats that were subjected to gentamicin-induced nephrotoxicity [37]. Nootropic Activity: The elevated plus maze model treated with methanolic extract showed nootropic effects [15]. Wound Healing Activity: An excision wound model showed signs of healing after flower methanolic

extract and emu oil were applied [38]. Anti-inflammatory: Traditionally used for its anti-inflammatory properties. These diverse pharmacological activities highlight the potential therapeutic benefits of *Bauhinia tomentosa* across various health conditions.

Table 3 Bioactivities of *Bauhinia. tomentosa* Linn [39].

| Bioactivity | Part used | Extract/Compound | Reference |
|-------------------------|------------|----------------------------|---|
| Antibacterial | Leaf | Aqueous, Ethanol | Rhama s et al. (2012) [31] |
| Hepatoprotective | Bark | Ethanol | Parimal p. Katolkar et al. (2014) [32] |
| Anti-cancer | Leaf | Methanol | Arumugam janaki et al. (2018) [29] |
| Diuretic | Roots | Ethanol | Ramdas bhat et al. (2023) [33] |
| Antioxidant | Flower | Ethanol | Mannangatti et al.(2010b) [34] |
| Analgesic | Roots | Aqueous, Methanol, Ethanol | Tiwari and Singh (2013) [10] |
| Anti-anxiety | Leaf | Ethanol | Sathya et al. (2011) [15] |
| Anticatatonic | Leaf | Ethanol | Sathya et al. (2011) [15] |
| Antidepressant | Leaf | Ethanol | Sathya et al. (2011) [15] |
| Antidiabetic | Flower | Ethanol | Mannangatti et al.(2010a) [16] |
| | Leaf | Aqueous | Devaki et al. (2011) [17] |
| | Root | Petroleum ether | Kaur et al. (2011) [18] |
| | Stem | Aqueous, Ethanol | Tiwari and Singh (2014) [35] |
| Antipyretic | Root, Stem | Methanol | Tiwari and Singh (2015) [36] |
| Anti-ulcerative colitis | Leaf | Methanol | Kannan and Guruvayoorappan (2013) [19] |
| Nephroprotective | Aerial | Ethanol | N.Akhitha, M.Raghavendra et al. (2019) [37] |
| Nootropic | Leaf | Ethanol | Sathya et al. (2011) [15] |
| Wound healing | Flower | Methanol | R.Ratna et al. (2017) [38] |

VIII. CONCLUSION

Review research on *Bauhinia tomentosa* Linn indicates that these plants have a vast amount of pharmacological potential. Many people firmly believe that comprehensive data on the different pharmacological and phytochemical characteristics of the extracts included in this review can offer comprehensive support for the application of this plant in a range of therapeutic applications. Regional differences exist in the phytochemical variety and therapeutic effectiveness of *Bauhinia tomentosa* Linn. A large portion of the global population still primarily obtains their medicine from plants today. The task of developing safe, effective, and reasonably priced medications still faces scientists, particularly in rural areas. In vitro, in vivo, and clinical trials are used to quantify these *Bauhinia tomentosa* Linn species, as well as to determine the quantity of each phytoconstituent and their pharmacological profiles.

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