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"PHYTOCHEMICAL AND PHARMACOLOGICAL ASPECTS OF *Bauhinia acuminata* Linn: A REVIEW"

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Abstract: *Bauhinia acuminata* Linn. is a small ornamental shrub from the Fabaceae family. It is widely grown for its beautiful white flowers and its use in traditional medicine. While it is native to Southeast Asia, it is commonly found in India, where people value it for its beauty and health benefits. Different parts of the plant, such as the leaves, bark, and flowers, contain many phytochemicals that contribute to its medicinal properties. Bioactive compounds, especially flavonoids and phenolic substances, play a key role in treating various health issues and support its traditional use in promoting well-being.

Objective: This review aims to provide detailed information on the pharmacological activities and therapeutic potential of *Bauhinia acuminata* Linn. It covers the plant's structure, distribution, and phytochemical components, focusing on its various bioactive compounds. The reported pharmacological effects include antioxidant, anti-inflammatory, antimicrobial, antidiabetic, hepatoprotective, and wound-healing activities, which are crucial to its medicinal importance. The review also looks at existing toxicological evidence to assess safety and tolerability, offering a clear overview that encourages further research and possible clinical uses.

Conclusion: *Bauhinia acuminata* Linn. is a promising medicinal plant packed with bioactive compounds that offer various therapeutic benefits. While initial findings support its medicinal potential, further studies are necessary to confirm its safety and effectiveness. This will help establish its role in modern medicine.

***Keywords – Bauhinia acuminata*, antioxidant, antidiabetic, hepatoprotective.**

I. INTRODUCTION

The healing properties of plants have always been a useful resource for humankind; such practices became the base of contemporary medicine. Its use has been recorded in a variety of forms, from extracts derived based on the principles of Western medicine, to traditional, energy-based herbal decoctions. The effects of a herb can differ from one person to another chiefly due to the fact that their substance is chemical in nature and can be influenced by many factors. [1] In identifying some of the early medicines, one might say they were a direct result of clinical, pharmacological, and chemical studies concerning various traditional medicines, a good number of which had a vegetal origin. To cite a few, there is the aspirin which is from willow bark, digitoxin from foxglove, morphine from the opium poppy, quinine which is derived from the cinchona bark, and pilocarpine from Jaborandi. Today, the practice of herbal medicine continues to be the main form of medicine for the estimated 75–80% of the world's population, especially in the poorer nations. Such high figures can be explained in large measure by the belief that herbal medicines pose few or no risks, almost always cost less, and can be found readily. [2]

Synthetic compositions of medicine do target symptoms of specific disease as per pathology but are still very different from herbal medicines which emphasize aiding the body's built-in healing processes. Take the example of arthritis which is frequently treated with steroidal anti-inflammatory medicines along with which arise the chances of certain other severe problems. [3] Within the family of Fabaceae plants, *Bauhinia Acuminata* specifically is the flowering shrub species which grows in the tropical biosphere of Southeast Asia and is often referred to as Small White *Bauhinia*, White Orchid Tree, and Snowy Orchid Tree. This bush is particularly adored due to the outward appearance of its various orchids. For the beautiful aesthetic and its potential medicinal properties, many cultivators around the world grow the shrub with great eagerness. [4]

A large number of plants which are used for medicinal purposes are known for having powerful antioxidant properties. Even though the actual actions of the many medicinal plants of herbs is often not completely understood, almost every medicinal plant displays clear signs of having considerable antioxidant properties. This antioxidant action is known to play an important role in and has been correlated with various ailments and disorders, such as memory loss, cancer, atherosclerosis, Alzehimer's, diabetes, other cardiovascular diseases and so much more. Moreover, the antioxidant capabilities offered by such medicinal herbs are utilized to offset the harmful effects brought by some toxic substances and or particular drugs. The complex mixture of herbal medicine used for various ailments contain a number of different constituents with some which are extremely complex in structure. For example, the polysaccharides, mucilages, and the tannins, which are known to influence, modulate, or alter the activities of the primary bioactive constituents of the plant. [3]

The dwarf white orchid tree, or *Bauhinia acuminata*, is a shrub that grows naturally in Southeast Asia's evergreen forests, especially in Indonesia, Malaysia, and the Philippines. Infusions of its bark, flowers, and roots are still used as folk remedies and are

thought to help prevent tuberculosis, demonstrating its importance in traditional medicine. The plant is prized for its aesthetic qualities in addition to its therapeutic uses, and it is frequently studied as a textbook species in horticulture, particularly in Western and Southern India. It grows best in full sun and prefers slightly acidic soils (pH 5.6–6.5), moderate watering, and partial shade. Despite the limited success of vegetative propagation techniques other than inarching, it reproduces easily through seeds that spontaneously spread when capsules. [5]

II. MORPHOLOGY

The *Bauhinia acuminata* is a medium sized tree characterized by a fast-growing trunk with darkness in color, thin ascending, hairy branches and a maximum height of 2 to 3 meters. It is a tree which loves sunlight and is usually found on rocky soils on the sides of hills, in valleys, and on sandy loam and loamy soils of slightly acidic pH. They grow best in soils which is not saline and its growth is usually 2 to 3 meters. Along with this the trunk is smooth, strong, and erect with a great number of slender branches. Twigs at this growth stage cross the bark, which is externally brown and grey, and rough with fissue, transverse cracks and exfolitions smooth at the inner with a cream color. Rain leaves are alternate, glabrous with margins and a venation which is a long and parallel. They possess sharp edges with a lobed and rounded structure which makes the leaf look like an ox hoof.

They are thin and smoothly glabrous on the top surface, densely puberulent on the lower side, and have a rounded or cordate base and acute lobes on the top. Their leaves and leaflets are also petiolate and often exhibit sleep movements. Purple, sparkling, bisexual, and pleasantly scented, the flowers have five petals (4-6 cm long), a 6-12 mm long pedicel, a 5-9 mm long hypanthium, and a spathaceous calyx limb 28-37 mm long with five spidery lobes (1.7-4.1 mm). The glabrous petals, which are neither clawed nor lobed, are Elliptic to oblanceolate (39-49 [up to 60] x 20-25 [up to 30] mm). There are ten fertile stamens with strigose base filaments and a stipitate ovary with a peltate, bilobed, and peltate stigma. Nicknamed the “Snowy Orchid Tree” for its resemblance to hanging snowflakes, the white flowers look like snowflakes that are cascading.

The elongated, linear pods, which are 7.5–15 × 1.7–1.8 cm (dry, hard, smooth, and brown), have about 10 mm spherical seeds. The Flowers, which have no peduncle at all, are about 2.5–5.8 cm long and arranged in axillary racemes. Bracts and bracteoles are also lance-linear and are about 3–9 mm pubescent at the margins only; they are also fallen. The cross-section of the lamina in the leaf shows polygonal epidermal cells, palisade mesophyll, and unicellular hairy cells. The lower cortex, which has simple long trichomes, is rather broad (6–7 layers) with stomata of the paracytic type. The leaf has the highest vein-islet number and palisade ratio of all species of *Bauhinia* studied, which indicates it’s the most advanced in those characteristics. [5]

III. PHYTOCHEMISTRY

Bauhinia acuminata, a common flowering shrub found in tropical South-East Asia, has her medical attributes spanning across stem, leaf, root, flower, and seed. Traditionally, these are used clinically to treat skin problems, ulcers. Phytochemical studies of *B. acuminata* have revealed the presence of vitamin C in the leaves, as well as beta-sitosterol, lupeol, active nutritional substances, and bioactive compounds, and flavonoid glycosides like 3,5,7-trihydroxy flavanone and 5,7-dimethoxy-flavanone 4-O-alpha-L-rhamnopyranosyl-beta-D-glucopyranosides. Some of the flavonoids present in *B. acuminata* are kaempferol, quercetin, and apigenin, which are commonly occurring. *B. acuminata* contains quercetin-3-glycoside, while Cassia occidentalis has quercetin-7-glycoside. Other leaves constituents are palmitic acid, gallic acid, and a mixture of acids: phthalic, and 3 phthalic acid esters. Phytochemical flavonoids screening reveals the presence of carbohydrates, oils, saponins, phenolic compounds, and fats in the leaves and the stems. The phenolic contents of *B. acuminata* serve as the major contributor of antioxidant compounds.

The plant has about 23% crude protein, 20.8% crude fiber, 24.9% lipids, and 48% carbohydrates, according to nutritional analysis. Moreover, various portions of the plant incorporate different chemical constituents, such as alkaloids, anthocyanosides, phenolic compounds, proteins, phlobatannins, steroids, tannins, flavonoids, anthraquinones, saponins, terpenes, resins, balsams, amino acids, carbohydrates, and even cardiac glycosides. [6]

IV. PHARMACOLOGICAL ACTIVITIES

Antidiabetic

In-vitro

The ability of the *Bauhinia acuminata* stem bark hydro-methanol (3:2) extract on the glucose metabolism regulation of tissues from streptozotocin diabetic rats was assessed. The extract was found to markedly suppress glucose-6-phosphatase activity in the liver as well as in the skeletal and cardiac muscle tissues ($p < 0.05$), indicating a decrease in glucose output from the liver. The activity of hexokinase was not altered, but the extract was found to be a strong inhibitor of enteric α-glucosidase, supporting an ability to diminish carbohydrate digestion and subsequently mitigate post-meal hyperglycemia. The data above illustrate the extract's ability to modulate key enzymes involved in glucose metabolism. Along with reducing glucose levels, the extract also showed potent antioxidant activity. Extract treatment restored antioxidant enzyme levels and TBARS concentration in the liver and kidney tissue and reduced lipid peroxidation and oxidative stress ($p < 0.05$). Moreover, lowered activities of GOT and GPT in treated groups suggest improved tissue integrity and reduced tissue toxicity. These observations emphasize the extract’s capability to bolster the antioxidant defenses that are in tissues of individuals with diabetes. [7]

In-vivo

The ethanolic flower extract of *Bauhinia acuminata* has shown promising antidiabetic effects in experimental models. In a study with alloxan-induced diabetic rats, taking the extract at a dose of 300 mg/kg significantly lowered blood glucose levels. The effects became more noticeable starting from the third day. Interestingly, the extract was more effective at reducing glucose levels than the standard drug glibenclamide during the observation period. Phytochemical screening found flavonoids, phenolic compounds, saponins, carbohydrates, and lipophilic constituents. These components help lower blood sugar by boosting insulin secretion, improving glucose uptake, and protecting pancreatic β-cells from oxidative damage. These findings support the traditional use of *B. acuminata* flowers in managing diabetes and emphasize their potential as a natural treatment for glycemic control. [8]

Hepatoprotective

Aerial part

The study assessed the protective activity of ethanolic and aqueous leaf extracts of *Bauhinia acuminata* on the liver of carbon tetrachloride (CCl_4) treated albino rats. The administration of CCl_4 significantly increased serum liver enzymes like SGPT, SGOT, and ALP, lipid peroxidation (MDA) levels, and decreased the antioxidant enzymes (GSH and CAT) demonstrating hepatic damage. Pre-treatment with standard doses of *B. acuminata* extracts (200 and 400 mg/kg) significantly altered the enzyme levels ($p < 0.001$) in a dose dependent manner. Enzyme levels after treatment with 400 mg/kg of the ethanolic extract nearly normal levels, comparable to the standard hepatoprotective drug silymarin, and the extract demonstrated the highest potency of all doses. Further, histopathological analysis showed the extracts were able to preserve the liver's form and functions. This confirms the traditional use of *B. acuminata* in herbal medicine and supports the idea that it has the potential to be developed as a herbal therapeutic for liver disease. [9]

Bark part

The combined protective efficacy of the aqueous extracts of the stem bark, leaves, as well as the roots of *Bauhinia acuminata* L. has been evaluated in Wistar albino rats with carbon tetrachloride (CCl_4)-induced hepatotoxicity. The silicate extract was made using the Soxhlet extraction method and was administered at doses of 200 mg/kg and 400 mg/kg. The reference standard was silimarins (100 mg/kg). The CCl_4 exposure period showed a significant increase in serum liver enzymes (SGPT, SGOT, ALP), lipid peroxidation (MDA) and total bilirubin, and a reduction in the antioxidant parameters such as catalases and glutathione. The extract of B. acuminata administered towards the later stages of the exposure period demonstrated a restoration of these values towards the normal range, dependent on the dosage. The greater efficacy was reported at the 400 mg/kg interval. The histological examination showed marked reduction in hepatic necrosis and fatty degeneration with an increase in the range of treated groups.

Phytochemical investigations showed the existence of a range of antioxidant and hepatoprotective alkaloids, flavonoids, glycosides, saponins, tannins, terpenoids, amino acids as well as vitamins such as quinones and vitamin C. This evidence of the *B. acuminata* becomes more salient with the fact that *B. acuminata* has a history of use in herbal liver medicine as a multifunctional herbal medicine.[10]

Anti-cancer

The anticancer activities of *Bauhinia acuminata* L. leaves were studied using chloroform extract (CEBA) and its ethyl acetate (EA) fraction using in vitro, in vivo and in silico methods. Cancer cell lines A549 and normal kidney cells, Vero, were studied in MTT assay. The EA fraction treated A549 cells with IC_{50} values that were much less than the values observed for control Vero cell line, signifying selective cytotoxicity. Reference drug used was doxorubicin. In vivo study involved induction of lung cancer with Benzo(a)pyrene in C57BL/6 mice. Dosing of CEBA EA fraction conjugated with doxorubicin was associated with improvement in volume of the tumor and normalisation of other biochemical index of serum, liver, lung and kidney. A statistically significant increase in antioxidant enzymes was observed after treatment, strengthening the hypothesis of the enhanced oxidation defense mechanism of the body in the treated animals. Treatment showed tissue recovery and increase in tumor suppressor gene P53 protein with the help of histological and immunohistochemical studies. Molecular docking studies shown strong binding affinities relating to phytoconstituents of the EA fraction with protein targets linked to lung cancer, supporting the mechanistic underpinning of the anticancer activity. *B. acuminata* appears to be a good candidate for a lung cancer therapy, which necessitates additional clinical research. [11]

Antimicrobial

Bauhinia acuminata bark and leaf antimicrobial activity were evaluated on known bacterial strains through the use of the agar well diffusion method. The extracts displayed moderate inhibitory zones on pathogens like *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. In general, bark extract had more activity. For control, kanamycin was utilized. The extracts may be possessing bioactive phytoconstituents such as alkaloids, flavonoids, and saponins. These extracts support the idea of using *B. acuminata* with the aim of developing more biocidal agents derived from plants. [12]

Cytotoxic Activity

The carbon tetrachloride fraction was lipophilic and shrimps exhibited LC_{50} values with notable cytotoxic action during the lethality test. The observed LC_{50} value was calculated to be 12.13 ± 0.21 µg/mL. This suggests the presence of bioactive compounds with potential anticancer properties. The brine shrimps lethality assay was performed for further confirmation. The shrimps which proved lethal with the carbon tetrachloride sample was fractionated further using classical liquid partition chromatography. The sample was further separated and bio assay guided fractioned to ultimately separate the active fraction. [13]

Membrane Stabilizing activity

Significant membrane stabilizing effects were demonstrated by the crude methanol extract of *B. acuminata* leaves in both hypotonic and heat-induced hemolysis scenarios. In contrast to the standard drug acetylsalicylic acid, which inhibited hemolysis of human erythrocytes by $81.97 \pm 0.77\%$ and $42.11 \pm 0.39\%$, respectively, it inhibited hemolysis by $63.94 \pm 0.14\%$ and $51.95 \pm 0.20\%$. These findings support the extract's long-standing application in inflammatory conditions by indicating that it may shield cellular membranes from damage brought on by stress. [13]

Thrombolytic Action

Using streptokinase as the reference standard, an in vitro clot lysis assay was used to evaluate thrombolytic potential. While streptokinase achieved 90% lysis, the flower extract only demonstrated a moderate clot lysis activity of 14.57 percent. Despite having a relatively minor effect, the extract's capacity to stimulate fibrinolysis raises the possibility of its use as an adjuvant in thrombotic disorders. [14]

Anti-inflammatory

Erythrocyte membrane stabilizing assays were used to assess the ex-vivo anti-inflammatory activity of *Bauhinia acuminata's* methanolic leaf extract and its solvent fractions in hypotonic and heat-induced environments. While CTCSF demonstrated the strongest effect under heat-induced hemolysis (853.3%), petroleum ether soluble fraction (PESF) and carbon tetrachloride soluble fraction (CTCSF) demonstrated the highest membrane stabilizing activity under hypotonic stress (418.26%). Aqueous soluble fraction (AQSF) and methanol soluble fraction (MESF) also showed moderate activity, indicating that the extract's anti-inflammatory properties are influenced by a number of fractions. According to these findings, B. acuminata leaves have strong membrane-protective qualities, most likely as a result of their phytochemical makeup. [15]

Wound Healing

Rats with excision wounds were used to test the effectiveness of wound healing. The methanolic extract was applied topically as a 5% ointment and taken orally at a dose of 250 mg/kg. From day 0 onward, the extract dramatically accelerated wound contraction, and the healing results were on par with those of the common medication povidone-iodine. In comparison to the control group, both treatment modalities demonstrated improved epithelialization and a shorter healing period. The extract's traditional use in treating skin infections and injuries is supported by the presence of tannins, saponins, and steroids, which probably helped with its tissue-repairing and anti-inflammatory properties. [16]

Antipyretic Action

The brewer's yeast-induced pyrexia model in Wistar rats was used to test the antipyretic activity. Both the 100 mg/kg and 200 mg/kg doses of the ethanolic flower extract significantly reduced elevated rectal temperatures; the effect started within the first hour and lasted for up to four hours. The extract's ability to modulate thermoregulatory centers and lower fever was demonstrated by its effectiveness, which was comparable to that of paracetamol (100 mg/kg). These findings support *B. acuminata's* traditional use in the treatment of feverish ailments and point to the possibility of its continued development as a natural antipyretic. [17]

Analgesic Action

The methanolic leaf extract's analgesic effectiveness was assessed using a variety of in vivo models, such as the hot plate, formalin-induced tonic pain, and acetic acid-induced visceral pain tests. The 200 mg/kg and 400 mg/kg doses of the extract significantly reduced pain ($p < 0.01$) in all models, demonstrating dose-dependent analgesic effects. The 100 mg/kg dose in the hot plate test exhibited a delayed onset of action, whereas the formalin model showed stronger analgesia in the late phase (10–30 min), suggesting both central and peripheral mechanisms. The outcomes were similar to those of conventional analgesics, indicating that *B. acuminata* leaf extract—specifically, its quercetin content—has potential for use in pain relief treatments. [18]

Anti-diarrheal

In vivo models of castor oil-induced diarrhea and magnesium sulfate-induced enteropooling were used to assess the antidiarrheal effectiveness of *Bauhinia acuminata's* methanolic leaf extract. The extract significantly decreased intestinal fluid accumulation by 50.66% and 66.66%, respectively, when given at doses of 200 mg/kg and 400 mg/kg body weight ($p < 0.01$). The extract also showed a dose-dependent decrease in diarrheal episodes in the castor oil model, suggesting that it suppresses intestinal motility by 41.89% to 58.33%. These outcomes were similar to those of the common medication loperamide (1 mg/kg), indicating that the leaves of *B. acuminata* have promising antidiarrheal qualities and could be used as a natural remedy for gastrointestinal issues. [19]

Anti-oxidant

Activity of Antioxidants DPPH and ABTS radical scavenging assays were used to evaluate antioxidant potential. When methanolic extracts of bark and leaves were tested, the leaf extract showed better activity because it contained more flavonoids and phenols. The DPPH assay measured absorbance at 515 nm following a 24-hour dark incubation period. The formula for calculating scavenging activity was % Inhibition = $((A_0 – A_t)/A_0) \times 100$, where A_0 represents the control absorbance and A_t represents the test absorbance. The standard was ascorbic acid. The leaf extract's antioxidant efficacy was further validated by the ABTS assay. These findings support the inclusion of *B. acuminata* in herbal antioxidant therapies and validate its traditional use in treating conditions related to oxidative stress. [20]

Antibacterial and Anti-biofilm Activity

Antibacterial tests with disc diffusion and anti-biofilm assays showed that the fruit extract effectively stopped bacterial growth and biofilm formation. Although it was not as strong as standard antibiotics, the extract had noticeable activity, especially in disrupting biofilm integrity, which is important for chronic infections. Molecular docking supported these effects, showing that rutin hydrate and kaempferol had strong binding affinities with bacterial protein targets. [21]

Anthelmintic Activity

The leaf extracts of *Bauhinia acuminata* were tested for anthelmintic activity against housefly larvae (*Musca domestica*). The extracts were prepared in aqueous and ethanolic forms at concentrations from 12.5 to 200 mg/mL. Albendazole was used as the standard, while distilled water acted as the control. The assay measured the times for paralysis and death of the larvae, showing that effectiveness depended on the dose. The ethanolic extract showed better activity than the aqueous extract, suggesting it contains strong bioactive compounds. Preliminary screening of the plant's chemicals confirmed the presence of tannins and saponins. These substances are known to disrupt worm metabolism and neuromuscular coordination. These findings suggest that *B. acuminata* leaves have promising anthelmintic properties and should be further tested in vivo for potential therapeutic use. [22]

Anti-hyperlipidaemic

As cardiovascular diseases (CVD) increase worldwide, especially in low- and middle-income countries, this study looked into the lipid-lowering potential of the ethanolic leaf extract of *Bauhinia acuminata* in rats with hyperlipidemia induced by an atherogenic diet. Preliminary tests confirmed the presence of flavonoids, alkaloids, steroids, and terpenoids. Acute toxicity testing (OECD

Guideline 423) found a safe dose up to 5000 mg/kg. The rats were divided into four groups: normal control, disease control, standard (atorvastatin 10 mg/kg), and test groups that received 200 mg/kg and 400 mg/kg of the extract. After 30 days, the 400 mg/kg dose resulted in significant drops in total cholesterol, triglycerides, VLDL, and random blood glucose, while raising HDL levels. The atherogenic index improved significantly (1.62) compared to the disease control (10) and standard group (3.11). These results indicate that *B. acuminata* leaf extract may provide effective lipid-lowering and heart-protective benefits. [23]

Anti-fungal

Bauhinia acuminata showed antifungal effects against important plant pathogens such as *Helminthosporium oryzae, Fusarium oxysporum, Rhizoctonia oryzae*, and *Aspergillus niger*. The leaf extract was tested using spore germination and agar cup methods. It showed moderate inhibition of spore germination and fungal growth, especially against *Fusarium* and *Helminthosporium*. These effects come from bioactive compounds like flavonoids and tannins, highlighting its potential as a natural antifungal agent. [24]

Anti-implantation

Recent studies have shown that *Bauhinia acuminata* Linn. has anti-fertility effects, especially its anti-implantation activity in female rats. In a controlled experiment, researchers gave aqueous and ethanolic leaf extracts orally at doses of 200 mg/kg and 400 mg/kg, using ethinyl estradiol as a standard reference. The ethanolic extract at 400 mg/kg significantly reduced implantation sites, indicating strong anti-implantation effects. This activity is linked to bioactive compounds like flavonoids, glycosides, saponins, and phenolic compounds, which may disrupt hormonal regulation or uterine receptivity.

Additionally, acute toxicity tests confirmed that the extract is safe up to 2000 mg/kg, following OECD guideline 423. These findings support the traditional use of *B. acuminata* for fertility regulation and suggest further research into its mechanism of action and potential as a plant-based contraceptive. [25]

Anti-arthritic Activity

Recent studies have shown that *Bauhinia acuminata* Linn. leaf extracts have anti-arthritic effects in formaldehyde-induced arthritis models using rats. Researchers administered both ethanolic and aqueous extracts orally at doses of 200 mg/kg and 400 mg/kg. Evaluations took place on days 0, 7, 14, 21, and 28.

- The ethanolic extract at 400 mg/kg had the strongest effect, reducing paw swelling by 70.24% on day 28 ($p < 0.01$).
- The aqueous extract at 400 mg/kg also significantly reduced inflammation, with a 58.68% decrease in paw volume ($p < 0.05$).
- Improvements were observed in blood parameters, suggesting wider anti-inflammatory effects.
- Phytochemical tests showed the presence of flavonoids, saponins, tannins, glycosides, and triterpenoids, which are known to affect inflammation pathways.

These results back the traditional use of *B. acuminata* for treating rheumatoid arthritis and offer a scientific foundation for its use in treating inflammatory joint issues. [26]

V. ASSESSMENT OF TOXICITY STUDIES

Acute toxicity study

The safety of *Bauhinia acuminata* leaf extracts was tested in acute toxicity studies using animal models, following OECD guideline 423. Both water-based and alcohol-based extracts were given by mouth to Swiss albino mice and Sprague Dawley rats at increasing doses up to 5000 mg/kg. There were no deaths or noticeable signs of toxicity during the 14-day observation period, showing a high safety margin. Behavioral observations, body weight, and organ structure stayed within normal ranges, suggesting that the extracts are non-toxic at therapeutic doses. These results support the safe use of the plant in medical applications and justify its inclusion in further preclinical studies.[27]

Subacute toxicity study

Subacute toxicity studies of *Bauhinia acuminata* leaf extracts were carried out to evaluate safety with long-term exposure. Experimental animals received daily oral doses of the extract for 28 straight days. No signs of illness, death, or changes in behavior were observed. Blood tests and chemical tests, including markers for liver and kidney function, stayed within normal ranges. This indicates there was no specific toxicity to these organs. A close examination of essential organs like the liver, kidney, and spleen showed no structural changes, inflammation, or cell death. This further confirms that the extract is not toxic at therapeutic doses. These results strengthen the plant's safety profile and support further research into its pharmacological uses. [5]

VI. CONCLUSION

Several important compounds, like flavonoids, phenolics, sterols, terpenoids, and glycosides, have been found in Bauhinia *acuminata*. Research using lab models and live subjects shows its potential for treatment, especially because of its antioxidant, anti-inflammatory, and antimicrobial properties. Due to its many medicinal uses, *B. acuminata* has received significant attention in ethnomedicine and is valued in traditional healing practices. As the global interest in safe, plant-based remedies grows, this species shows promise for creating new drugs and health products. However, more studies and clinical trials are needed to confirm its effectiveness and ensure it can be used safely for treatment.

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