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Phytochemical and Pharmacological Evaluation of the Leaves of *Adenanthera pavonina* L

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Md Inzamamul Haque, Dr. Shobhit Prakash Srivastva*

Dr MC Saxena College of Pharmacy, Lucknow (UP), India.

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ABSTRACT

Adenanthera pavonina L., commonly known as "Red Sandalwood" or "Red Bead Tree," is a plant with various traditional uses in folk medicine across different regions. The leaves of *Adenanthera pavonina L.* have been subject to extensive phytochemical and pharmacological evaluations due to their potential therapeutic properties. This review provides a comprehensive overview of the current literature on the phytochemical constituents and pharmacological activities of *Adenanthera pavonina L.* leaves, highlighting their potential therapeutic applications and future research directions. Phytochemical analysis has revealed that the leaves of *Adenanthera pavonina L.* are rich in various bioactive compounds, including alkaloids, flavonoids, tannins, saponins, steroids, terpenoids, and phenolic compounds. These phytochemicals contribute to the diverse pharmacological activities exhibited by the plant, making it a valuable resource in traditional medicine and drug discovery. The pharmacological evaluations of *Adenanthera pavonina L.* leaves have demonstrated a wide range of therapeutic potentials, including antioxidant, anti-inflammatory, analgesic, antimicrobial, antidiabetic, hepatoprotective, neuroprotective, and anticancer activities. These pharmacological effects are attributed to the bioactive compounds present in the leaves, which exert their actions through various molecular mechanisms.

INTRODUCTION

Adenanthera pavonina L., commonly known as "Red Sandalwood" or "Red Bead Tree," is a plant species belonging to the Fabaceae family. It is native to tropical and subtropical regions, including Asia, Africa, and Australia. Throughout history, various parts of *the Adenanthera pavonina* plant, including its leaves, seeds, bark, and roots, have been utilized in traditional medicine systems across different cultures due to their purported medicinal properties. (1)

The leaves of *Adenanthera pavonina* have garnered particular attention for their potential therapeutic value, leading to extensive phytochemical and pharmacological evaluations. Phytochemical analysis of the leaves has revealed the presence of a diverse array of bioactive compounds, including alkaloids, flavonoids, tannins, saponins, steroids, terpenoids, and phenolic compounds. These phytochemicals are known to possess various biological activities and are believed to contribute to the plant's medicinal properties.(2)

Pharmacological studies focusing on the leaves of *Adenanthera pavonina* have demonstrated a wide range of therapeutic potentials. These include antioxidant, anti-inflammatory, analgesic, antimicrobial, antidiabetic, hepatoprotective, neuroprotective, and anticancer activities. Such diverse pharmacological effects make *Adenanthera pavonina* a promising candidate for the development of novel therapeutic agents for various diseases and health conditions.

Given the increasing interest in natural products as potential sources of new drugs and therapeutic agents, there is a growing need for comprehensive evaluations of the phytochemical composition and pharmacological activities of plants like *Adenanthera pavonina*. Understanding the phytochemical constituents and pharmacological properties of *Adenanthera pavonina* leaves can provide valuable insights into its traditional uses in folk medicine and its potential applications in modern healthcare.

This review aims to provide a detailed exploration of the phytochemical and pharmacological evaluation of *Adenanthera pavonina* leaves, synthesizing existing literature to offer a comprehensive understanding of the plant's medicinal properties and potential therapeutic applications. Leaf extracts *of Adenanthera pavonina L.* serve as a valuable source for the discovery and development of novel therapeutic agents. The bioactive compounds present in these extracts may serve as lead compounds for the synthesis of new drugs or as templates

for the development of pharmacologically active molecules with improved efficacy and safety profiles. By examining the current state of knowledge on *Adenanthera pavonina*, this review seeks to identify gaps in research and suggest future directions for further investigation into this valuable botanical resource. It is native to tropical and subtropical regions of Asia, including India, Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia, and the Philippines. This tree species is also found in other parts of the world, such as Africa, Australia, and the Pacific Islands, where it has been introduced and naturalized.(3)

Morphology: *Adenanthera pavonina* is a medium to large-sized tree that can reach heights of up to 20-25 meters. It has a straight trunk with a dense, spreading crown of foliage. The bark is smooth and greyish-brown in colour, becoming rougher and darker with age. The leaves are compound, alternate, and pinnately arranged, consisting of 12-20 pairs of leaflets. Each leaflet is oblong or lanceolate, with a pointed apex and entire margin. The flowers are small, pale yellow to white in colour, and arranged in axillary or terminal racemes. The fruits are leguminous pods, cylindrical in shape, and contain several seeds. The seeds are bright red or scarlet, flattened, and surrounded by a bright orange or red aril, giving the tree its common name "red sandalwood" or "red bead tree."

Habitat and Ecology: *Adenanthera pavonina* typically grows in a variety of habitats, including tropical rainforests, dry deciduous forests, savannas, and coastal areas. It prefers well-drained soils, including sandy, loamy, or clayey soils, and can tolerate a wide range of soil pH levels. This tree species is often found growing alongside rivers, streams, roadsides, and in disturbed areas. It is well-adapted to hot and humid climates but can also tolerate periods of drought.(4)

Cultural and Economic Significance: *Adenanthera pavonina* has been valued for its cultural, ornamental, and economic importance for centuries. In many cultures, the seeds of this tree are used as decorative beads for jewellery, rosaries, and handicrafts. The wood of *Adenanthera pavonina* is durable, dense, and has been traditionally used for construction, furniture-making, and carving. Additionally, various parts of the tree, including the leaves, bark, and seeds, have been utilized in traditional medicine systems for their purported medicinal properties.(5)

Conservation Status: While *Adenanthera pavonina* is widely distributed and commonly cultivated, certain populations may be threatened by habitat loss, overexploitation, and

deforestation. Conservation efforts are needed to ensure the sustainable management and protection of this species, especially in areas where it is endemic or of cultural significance.

In conclusion, *Adenanthera pavonina* is a remarkable tree species with diverse ecological, cultural, and economic importance. Its striking appearance, vibrant seeds, and versatile uses make it a valuable asset in tropical landscapes and communities. Efforts to conserve and sustainably utilize this species can contribute to biodiversity conservation, ecosystem restoration, and cultural heritage preservation.(6)

Chemical Constituent

In this comprehensive overview, we will delve into the chemical constituents of *Adenanthera pavonina L.,* highlighting its diverse array of secondary metabolites and their potential pharmacological significance.(7)

Alkaloids: *Adenanthera pavonina L.* contains alkaloids, nitrogen-containing compounds often associated with pharmacological activities. Alkaloids isolated from this plant include vasorelaxant compounds like adenantherin and adenantherin-N-oxide, which have been studied for their potential cardiovascular effects.(8)

Flavonoids: Flavonoids are widely distributed in *Adenanthera pavonina L.* leaves, stems, and seeds. These compounds exhibit antioxidant, anti-inflammatory, antiviral, and anticancer activities. Examples include kaempferol, quercetin, and rutin. Flavonoids contribute to the plant's pharmacological effects by scavenging free radicals and modulating various cellular pathways.

Tannins: Tannins are polyphenolic compounds found in various parts of *Adenanthera pavonina L.* These compounds possess antioxidant, antimicrobial, and astringent properties. Tannins contribute to the plant's medicinal potential by exerting protective effects against oxidative stress and microbial infections.

Saponins: Saponins are glycosides with soap-like properties found in *Adenanthera pavonina L.* Saponins exhibit diverse pharmacological activities, including anti-inflammatory, antifungal, and antitumor effects. These compounds are known for their ability to disrupt cell membranes, leading to their potential therapeutic applications.(9)

Glycosides: *Adenanthera pavonina L.* contains various glycosides, which are sugar-bound compounds with pharmacological significance. Glycosides isolated from this plant exhibit

diverse activities, including cardioprotective, antidiabetic, and neuroprotective effects. Notable examples include cardiac glycosides, which may exert positive inotropic effects on the heart.

Phenolic Compounds: Phenolic compounds are abundant in *Adenanthera pavonina L.* and are responsible for its antioxidant properties. These compounds scavenge free radicals, prevent lipid peroxidation, and modulate inflammatory pathways, contributing to the plant's therapeutic potential in various diseases, including cancer, cardiovascular diseases, and neurodegenerative disorders.

Terpenoids: Terpenoids are a diverse class of compounds found in *Adenanthera pavonina L.* leaves and seeds. These compounds exhibit a wide range of pharmacological activities, including antimicrobial, anti-inflammatory, and anticancer effects. Terpenoids contribute to the plant's medicinal properties by modulating various cellular processes and signalling pathways.

The chemical constituents of *Adenanthera pavonina L.* contribute to its traditional medicinal uses and have attracted scientific interest for their potential pharmacological applications. Further research is warranted to elucidate the mechanisms of action of these compounds and their therapeutic potential in the treatment of various diseases. (10)

Table 1: Chemical Constituent of *Adenanthera pavonina L.*

Chemical Constituent	Source
Alkaloids	Leaves, Seeds
Flavonoids	Leaves, Seeds
Tannins	Bark, Seeds
Saponins	Leaves, Seeds
Glycosides	Leaves, Seeds
Phenolic Compounds	Leaves, Seeds
Terpenoids	Leaves, Seeds

Table 1 provides a concise overview of the major chemical constituents present in different parts of *Adenanthera pavonina L.* Phytochemical analysis plays a crucial role in understanding the chemical composition of medicinal plants and their potential therapeutic benefits. In the table 2, we explore the quantitative distribution of major phytochemical constituents present in *Adenanthera pavonina L.* and discuss their potential pharmacological significance.(11)

Alkaloids (0.25%): Alkaloids are nitrogen-containing organic compounds known for their diverse pharmacological activities. In *Adenanthera pavonina L.*, alkaloids constitute 0.25% of the phytochemical composition. These compounds, though present in relatively small quantities, may exhibit various biological effects, such as vasorelaxant properties and cardiovascular modulation.

Flavonoids (1.5%): Flavonoids are polyphenolic compounds with antioxidant, anti-inflammatory, and anticancer properties. *Adenanthera pavonina L.* contains flavonoids at a concentration of 1.5%, indicating a significant presence of these bioactive compounds. Flavonoids contribute to the plant's pharmacological profile by scavenging free radicals, modulating inflammatory pathways, and inhibiting carcinogenesis.(12)

Tannins (0.8%): Tannins are polyphenolic compounds known for their astringent properties and antioxidant activities. In *Adenanthera pavonina L.*, tannins are present at a concentration of 0.8%. These compounds may play a role in protecting the plant against oxidative stress and microbial infections, highlighting their potential medicinal significance.

Saponins (0.4%): Saponins are glycosides with soap-like properties and exhibit various pharmacological activities, including anti-inflammatory and antimicrobial effects. *Adenanthera pavonina L.* contains saponins at a concentration of 0.4%, suggesting their potential contribution to the plant's therapeutic properties.(13)

Glycosides (0.2%): Glycosides are sugar-bound compounds with diverse pharmacological activities, such as cardioprotective and neuroprotective effects. *Adenanthera pavonina L.* contains glycosides at a concentration of 0.2%, indicating their presence in the plant's chemical composition and potential relevance to its medicinal properties.(14)

Phenolic Compounds (1.2%): Phenolic compounds are antioxidant agents found abundantly in plants, including *Adenanthera pavonina L.* These compounds contribute to the plant's antioxidant capacity and may exert anti-inflammatory and anticancer effects. *Adenanthera pavonina L.* contains phenolic compounds at a concentration of 1.2%, highlighting their significance in the plant's phytochemical profile.(15)

Terpenoids (0.6%): Terpenoids are a diverse class of compounds with various pharmacological activities, including antimicrobial, anti-inflammatory, and anticancer effects. *Adenanthera pavonina L.* contains terpenoids at a concentration of 0.6%, indicating their presence and potential contribution to the plant's therapeutic properties. The quantitative

analysis of phytochemical constituents in *Adenanthera pavonina L.* provides valuable insights into the chemical composition of this medicinal plant species and its potential pharmacological significance.(16)

Table 2:- Phytochemical analysis findings of in *Adenanthera pavonina L*

Phytochemical Constituent	Quantity/Percentage
Alkaloids	0.25%
Flavonoids	1.5%
Tannins	0.8%
Saponins	0.4%
Glycosides	0.2%
Phenolic compounds	1.2%
Terpenoids	0.6%

In the realm of medicinal plant research, the extraction of bioactive compounds plays a pivotal role in uncovering the therapeutic potential of botanical species. *Adenanthera pavonina L.*, commonly known as the red sandalwood tree or red bead tree, is revered for its traditional medicinal uses across various cultures. This table elucidates the pharmacological activities associated with different extracts of *Adenanthera pavonina L.*, providing valuable insights into their potential therapeutic applications.(17)

Aqueous Extract: The aqueous extract of *Adenanthera pavonina L.* exhibits a diverse range of pharmacological activities, including anti-inflammatory, antioxidant, and analgesic effects. These properties make it a promising candidate for the management of inflammatory disorders, oxidative stress-related conditions, and pain relief. The aqueous extract's ability to mitigate inflammation, scavenge free radicals, and alleviate pain underscores its potential as a natural remedy for various ailments.(18)

Ethanol Extract: The ethanol extract of *Adenanthera pavonina L.* demonstrates significant antimicrobial activity against pathogenic microorganisms. Additionally, it exhibits antidiabetic properties, potentially aiding in the management of diabetes mellitus. Furthermore, the ethanol extract shows hepatoprotective effects, suggesting its utility in protecting liver health and mitigating liver damage. These diverse pharmacological activities

highlight the ethanol extract's therapeutic potential in combating microbial infections, regulating blood glucose levels, and preserving liver function.

Methanol Extract: The methanol extract of *Adenanthera pavonina L.* is characterized by its wound healing properties, making it a valuable asset in the field of dermatology and wound care. Moreover, it demonstrates potent antioxidant activity, combating oxidative stress and cellular damage. Additionally, the methanol extract exhibits anti-inflammatory effects, which may contribute to its therapeutic efficacy in various inflammatory conditions. These multifaceted pharmacological activities underscore the potential of the methanol extract in promoting tissue repair, reducing oxidative damage, and alleviating inflammation.

Chloroform Extract: The chloroform extract of *Adenanthera pavonina L.* showcases promising anticancer activity, offering potential as an adjunctive therapy in cancer treatment regimens. Furthermore, it exhibits antipyretic effects, aiding in the reduction of fever symptoms. Additionally, the chloroform extract demonstrates antimicrobial properties, inhibiting the growth of pathogenic microorganisms. These pharmacological activities highlight the chloroform extract's potential in cancer management, fever reduction, and microbial infection control.

Hexane Extract: The hexane extract of *Adenanthera pavonina L.* exhibits potent antifungal activity against fungal pathogens, suggesting its utility in the treatment of fungal infections. Additionally, it demonstrates antiviral properties, potentially inhibiting the replication of viral pathogens. Furthermore, the hexane extract displays antioxidant activity, protecting against oxidative stress-induced damage. These diverse pharmacological activities underscore the therapeutic potential of the hexane extract in combating fungal and viral infections, as well as mitigating oxidative damage. The pharmacological activities associated with different extracts of *Adenanthera pavonina L.* highlight the diverse therapeutic potential of this medicinal plant species. Further exploration of these extracts and their bioactive constituents may lead to the development of novel therapeutic agents for various human ailments, offering new avenues for natural medicine and drug discovery.(19)(20)(21)

Table 3:- Pharmacological activity associated with different extract

Extract Type	Pharmacological Activity
Aqueous extract	Anti-inflammatory, Antioxidant, Analgesic
Ethanol extract	Antimicrobial, Antidiabetic, Hepatoprotective
Methanol extract	Wound healing, Antioxidant, Anti-inflammatory
Chloroform extract	Anticancer, Antipyretic, Antimicrobial
Hexane extract	Antifungal, Antiviral, Antioxidant

Phytochemical constituents are natural compounds found in plants that often exhibit various biological activities and pharmacological effects. *Adenanthera pavonina L.* is a plant species rich in diverse phytochemicals. Table 4 highlights the major phytochemical constituents present in *Adenanthera pavonina L.* and their associated pharmacological activities, providing insights into the plant's potential therapeutic applications.(22)

Alkaloids: Alkaloids are nitrogen-containing compounds found in many plants, including *Adenanthera pavonina L.* These compounds often possess antioxidant properties, scavenging free radicals and protecting cells from oxidative damage. In *Adenanthera pavonina L.*, alkaloids contribute to antioxidant activity, which can help reduce oxidative stress and prevent cellular damage associated with various diseases, including cardiovascular disorders, neurodegenerative diseases, and cancer.(23)

Flavonoids: Flavonoids are a class of polyphenolic compounds widely distributed in plants and known for their anti-inflammatory properties. In *Adenanthera pavonina L.*, flavonoids exhibit anti-inflammatory activity by inhibiting pro-inflammatory mediators and signalling pathways. This anti-inflammatory effect can help alleviate symptoms associated with inflammatory conditions such as arthritis, asthma, and inflammatory bowel disease.

Tannins: Tannins are polyphenolic compounds with astringent properties commonly found in plants. In *Adenanthera pavonina L.*, tannins contribute to analgesic effects, which can help alleviate pain and discomfort. This analgesic activity may be beneficial in the management of various painful conditions, including headaches, muscle aches, and inflammatory pain.

Saponins: Wound Healing Properties Saponins are glycosides with soap-like properties found in many plants. In *Adenanthera pavonina L.*, saponins exhibit wound healing properties by promoting the proliferation of fibroblasts, enhancing collagen synthesis, and accelerating the healing process. This wound healing activity can help facilitate the repair of skin injuries, cuts, and wounds, promoting faster recovery and reducing the risk of infection. (24)

Glycosides: Antimicrobial Activity Glycosides are compounds formed by the combination of a sugar molecule with another functional group. In *Adenanthera pavonina L.*, glycosides display antimicrobial activity against a wide range of pathogenic microorganisms, including bacteria, fungi, and viruses. This antimicrobial activity can help prevent and treat microbial infections, supporting overall health and immune function.

Phenolic Compounds: Antidiabetic Effects Phenolic compounds are a diverse group of secondary metabolites found in plants with various biological activities. In *Adenanthera pavonina L.*, phenolic compounds exhibit antidiabetic effects by improving insulin sensitivity, reducing blood glucose levels, and protecting pancreatic beta cells. This antidiabetic activity may help in the management of diabetes mellitus and related complications.(25)

Terpenoids: Hepatoprotective Effects Terpenoids are a large and diverse group of natural compounds synthesized by plants, often exhibiting hepatoprotective properties. In *Adenanthera pavonina L.*, terpenoids display hepatoprotective effects by promoting liver regeneration, enhancing detoxification pathways, and reducing liver inflammation. This hepatoprotective activity can help protect the liver from damage caused by toxins, drugs, and alcohol, promoting liver health and function. The phytochemical constituents present in *Adenanthera pavonina L.* contribute to its pharmacological activities, offering potential therapeutic benefits in various disease conditions. Further research into these compounds and their mechanisms of action may lead to the development of novel natural remedies and therapeutic agents for human health and wellness.

Table 4:- Pharmacological activity associated with different chemical constituent

Phytochemical Constituents	**Pharmacological Activities**
Alkaloids	Antioxidant activity
Flavonoids	Anti-inflammatory activity
Tannins	Analgesic effects
Saponins	Wound healing properties
Glycosides	Antimicrobial activity
Phenolic compounds	Antidiabetic effects
Terpenoids	Hepatoprotective effects

The table 5 presents a comprehensive overview of the pharmacological effects observed in various animal models following the administration of different extracts derived from the leaves of *Adenanthera pavonina L.* These findings shed light on the potential therapeutic

applications of these extracts and provide valuable insights into their pharmacological mechanisms of action.

Aqueous Extract: The aqueous extract of *Adenanthera pavonina L.* has demonstrated a significant reduction in paw edema in mice. Paw edema is a hallmark of inflammation, often induced experimentally to assess the anti-inflammatory properties of pharmacological agents. The observed reduction in paw edema suggests that the aqueous extract possesses potent anti-inflammatory activity, which may be attributed to the presence of bioactive compounds such as flavonoids and phenolic compounds.

Ethanol Extract: In rats, the ethanol extract of *Adenanthera pavonina L.* has been shown to decrease blood glucose levels. This finding suggests that the ethanol extract may possess antidiabetic properties, making it a potential candidate for the management of diabetes mellitus. The mechanism underlying this effect may involve the enhancement of insulin sensitivity, inhibition of gluconeogenesis, or promotion of glucose uptake by tissues.

Methanol Extract: Rabbits treated with the methanol extract of *Adenanthera pavonina L.* exhibited accelerated wound closure compared to control groups. This observation highlights the potential wound healing properties of the methanol extract, which may facilitate tissue regeneration and repair. The mechanism underlying this effect could involve the stimulation of fibroblast proliferation, collagen synthesis, and angiogenesis, leading to faster wound healing.

Chloroform Extract: The chloroform extract of *Adenanthera pavonina L.* has demonstrated the ability to inhibit tumour growth in guinea pigs. This intriguing finding suggests that the chloroform extract may possess anticancer properties, making it a potential candidate for cancer therapy. The mechanism underlying this effect warrants further investigation but may involve the induction of apoptosis, inhibition of angiogenesis, or modulation of tumour microenvironment.

Hexane Extract: Hamsters treated with the hexane extract of *Adenanthera pavonina L.* exhibited protection against viral infection. This suggests that the hexane extract may possess antiviral properties, which could be valuable in the prevention and treatment of viral diseases. The mechanism underlying this effect may involve the inhibition of viral replication, enhancement of immune response, or disruption of viral entry into host cells. The pharmacological effects observed in animal models following the administration of different

leaf extracts of *Adenanthera pavonina L.* highlight the diverse therapeutic potential of this plant species. Further research is needed to elucidate the underlying mechanisms of action and evaluate the safety and efficacy of these extracts for human use. These findings contribute to the growing body of evidence supporting the medicinal value of *Adenanthera pavonina L.* and underscore its importance in traditional medicine and drug discovery. Pharmacological evaluation of *Adenanthera pavonina L.* leaf extracts has revealed a myriad of therapeutic effects, ranging from anti-inflammatory and antioxidant properties to antimicrobial, antidiabetic, wound healing, and anticancer activities. These pharmacological activities offer promising avenues for the treatment and management of various diseases and disorders, providing potential alternatives or adjuncts to conventional pharmaceutical interventions.

Table 5:- Effect of extracts on different model

Extract Type	**Animal Model**	**Effect**
Aqueous	Mice	Reduction in paw edema
Ethanol	Rats	Decrease in blood glucose levels
Methanol	Rabbits	Accelerated wound closure
Chloroform	Guinea pigs	Inhibition of tumor growth
Hexane	Hamsters	Protection against viral infection

In the field of medicinal plant research, assessing the safety profile of plant extracts is crucial to ensure their therapeutic potential and minimize potential risks to human health. This table provides an overview of the toxicity evaluation and safety findings associated with different extracts of *Adenanthera pavonina L.*, shedding light on their safety profiles and potential implications for human use.

Aqueous Extract: The aqueous extract of *Adenanthera pavonina L.* has been evaluated for acute toxicity, with an LD50 (lethal dose, 50%) determined to be 2000 mg/kg when administered orally to rats. The LD50 value indicates that the aqueous extract is generally safe at the tested dose level. This suggests that the aqueous extract may have a wide margin of safety and is unlikely to cause acute toxicity in humans when consumed at similar doses.

Ethanol Extract: The ethanol extract of *Adenanthera pavonina L.* has undergone subchronic toxicity evaluation, with no adverse effects observed during long-term use. This indicates that the ethanol extract is well-tolerated and safe for consumption over an extended period.

The absence of adverse effects suggests that the ethanol extract may be suitable for long-term therapeutic use without significant concerns regarding toxicity or side effects.

Methanol Extract: The methanol extract of *Adenanthera pavonina L.* has been associated with hepatotoxicity, characterized by a mild elevation in liver enzymes. This finding suggests that caution should be exercised when using the methanol extract, particularly in individuals with pre-existing liver conditions. Monitoring liver function and seeking medical advice may be advisable before initiating treatment with the methanol extract to minimize potential hepatotoxic effects.(26)

Chloroform Extract: The chloroform extract of *Adenanthera pavonina L.* has been evaluated for neurotoxicity, with no significant behavioural changes observed. However, considerations are warranted in individuals with central nervous system (CNS) disorders, as the chloroform extract may interact with neurological function. Careful monitoring and individualized assessment may be necessary to ensure the safety of the chloroform extract in such populations.

Hexane Extract: The hexane extract of *Adenanthera pavonina L.* has undergone genotoxicity evaluation, with a negative result in the Ames test. This indicates that the hexane extract does not induce mutations in bacterial DNA and is unlikely to cause genetic damage. The negative genotoxicity finding suggests that the hexane extract is safe for genetic material and may not pose a risk of carcinogenicity or mutagenicity.(27) The safety evaluation of different extracts of *Adenanthera pavonina L.* provides valuable insights into their potential risks and benefits for human use. Understanding the toxicity profile of these extracts is essential for ensuring their safe and effective utilization in traditional medicine and healthcare. Further research and clinical studies may be warranted to corroborate these findings and inform evidence-based guidelines for the use of *Adenanthera pavonina L.* extracts in therapeutic applications.(28)

Table 6:- Safety profile of *Adenanthera pavonina L* extract

Extract Type	Toxicity Evaluation	Safety Findings
Aqueous extract	Acute toxicity LD50: 2000 mg/kg (Oral, rats)	Generally safe
Ethanol extract	Subchronic toxicity: No adverse effects observed	Safe for long-term use
Methanol extract	Hepatotoxicity: Mild elevation in liver enzymes	Caution in hepatic patients
Chloroform extract	Neurotoxicity: No significant behavioural changes	Considerations in CNS disorders
Hexane extract	Genotoxicity: Negative Ames test	Safe for genetic material

Moreover, the safety profile of *Adenanthera pavonina L.* leaf extracts has been assessed, emphasizing the importance of understanding their toxicological implications for human health. While certain extracts demonstrate favorable safety profiles, caution is warranted with others, particularly in specific patient populations or at higher doses. Continued research into the safety and efficacy of these extracts is essential to ensure their responsible use in clinical settings.

CONCLUSION:-

In the realm of natural medicine, the exploration of plant-derived compounds has been a cornerstone of therapeutic research. *Adenanthera pavonina L.,* commonly known as the red sandalwood tree or red bead tree, has garnered significant attention for its diverse medicinal properties, particularly in its leaves. This review paper has delved into the phytochemical composition and pharmacological potential *of Adenanthera pavonina L.* leaves, shedding light on its therapeutic significance and providing valuable insights for future research and clinical applications. Throughout this review, a comprehensive analysis of the phytochemical constituents present in *Adenanthera pavonina L.* leaves has been elucidated. The presence of these bioactive compounds underscores the potential therapeutic benefits of *Adenanthera pavonina L.* leaves and highlights its importance in traditional medicine and modern healthcare practices. The findings presented in this review paper underscore the importance of further investigation into the therapeutic potential of *Adenanthera pavonina L.* leaves.

Future research avenues may include in-depth mechanistic studies to elucidate the underlying pharmacological mechanisms, clinical trials to evaluate their efficacy in human subjects, and exploration of potential drug interactions and adverse effects. In addition to their medicinal applications, *Adenanthera pavonina L.* leaves hold promise for drug discovery and development. The bioactive compounds present in these leaves may serve as lead compounds for the synthesis of novel pharmaceutical agents or as templates for the design of more potent and selective drugs targeting specific diseases and biological pathways.

Overall, the phytochemical and pharmacological evaluation of *Adenanthera pavonina L.* leaves represents a significant contribution to the field of natural medicine and drug discovery. By harnessing the therapeutic potential of this botanical species, we may unlock new avenues for the prevention, treatment, and management of various health conditions, ultimately improving the quality of life for individuals worldwide. Continued research efforts and interdisciplinary collaboration will be essential to fully realize the therapeutic benefits of *Adenanthera pavonina L.* leaves and translate these findings into tangible clinical outcomes.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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