

**A SYSTEMIC REVIEW ON PALASH (BUTEA MONOSPERMA)**

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**ABSTRACT:**

Palash (*Butea monosperma*), also recognized as Flame of the Forest, bears immense significance in diverse regions across the Indian subcontinent and Southeast Asia, spanning cultural, ecological, and medicinal domains. This review aims to present a thorough overview of Palash, covering its botanical traits, traditional medicinal applications, ecological contributions, and recent scientific evaluations. Botanically, Palash stands as a deciduous tree within the Fabaceae family, distinguished by its striking orange-red blooms and unique leaf structure. Flourishing across a range of habitats from dry deciduous forests to tropical savannas, it plays a pivotal role in upholding biodiversity and fostering ecosystem resilience. The traditional medicinal utility of Palash finds extensive documentation in Ayurveda and other indigenous healing systems. Various parts of the tree, encompassing leaves, flowers, bark, and seeds, have been employed in addressing a broad spectrum of ailments such as skin conditions, gastrointestinal disorders, diabetes, and inflammation. Recent pharmacological investigations have commenced to validate several of these traditional uses, shedding light on the potential of Palash as a wellspring of bioactive compounds with therapeutic efficacy. Moreover, Palash serves as a crucial asset for numerous indigenous communities, offering sustenance, animal fodder, timber, dye, and various non-timber forest resources. Its cultural importance resonates through religious ceremonies, folk customs, and artistic representations, ingraining it deeply within the cultural tapestry of many societies. However, despite its ecological and cultural significance, Palash confronts various threats including habitat degradation, deforestation, excessive exploitation, and disturbances induced by climate change. These challenges underscore the urgent need for concerted conservation efforts to safeguard this invaluable botanical treasure for future generations.

**Keywords:** Monosperma, Flourishing, degradation, deforestation, pharmacological, leaves, flowers

### **Introduction:**

*Butea monosperma*, commonly referred to as Flame of the forest, belongs to the Fabaceae family and is known by various local names such as palash, mutthuga, bijasneha, dhak, khakara, chichra, Bastard Teak, Bengal Kino, and Nourouc. This tree species is found extensively across India, Burma, and Ceylon, except in extremely arid regions. The collection and display of *Butea monosperma* pods are recommended before the arrival of the rainy season. The plant readily generates root suckers, facilitating vegetative propagation. The genus *Butea* also encompasses other species like *Butea monosperma parviflora*, *Butea minor*, and *Butea superba*, which are widely distributed throughout India. The flowers of *Butea monosperma* have significant traditional medicinal uses for treating hepatic disorders, viral hepatitis, diarrhea, and as a depurative and tonic. They are also rich in flavonoids, including Butein, Butrin, Isobutrin, Plastron, Coreipsin, and Isocoreipsin. Medicarpin, known for its antifungal properties, has also been extracted from the flowers. Various flavonoids such as Butin, Butein, Butrin, Isobutrin, Palasitrin, Coreopsin, Isocoreopsin, Sulphuresin, Monospermoside, Isomonospermoside, and 7,3,4-trihydroxyflavone have been identified from the flowers of this plant species. Additionally, Euphane triterpenoid 3 $\alpha$ -hydroxyeuph-25-ene and the alcohol 2,14-dihydroxy-11,12-dimethyl-8-oxo-octadec-11-enylcyclohexane have been isolated from the stem. Palasimide, an imide compound, has been discovered in the pods of *Butea monosperma*. Research on antioxidant levels following ulceration suggests an association between free radicals and pylorus ligation and ethanol-induced ulceration in rats. This indicates a potential role for *Butea monosperma* in managing conditions related to oxidative stress.

### Botanical description (morphology)

*Butea monosperma*, commonly known as the Flame of the Forest or Bastard Teak, is a deciduous tree native to the Indian subcontinent, Southeast Asia, and parts of China. Here's a morphological description of *Butea monosperma*:

**Size:** *Butea monosperma* is a medium to large-sized tree, typically reaching heights of 15 to 25 meters (49 to 82 feet). However, under favorable conditions, it can grow even taller.

**Trunk:** The trunk of *Butea monosperma* is often stout and cylindrical, with a rough bark surface that is grayish-brown in color. As the tree matures, the bark becomes deeply furrowed and rough.

**Leaves:** The leaves are compound and pinnate, arranged alternately along the branches. Each leaf typically consists of 3 leaflets, though sometimes there may be 5 leaflets. The leaflets are elliptical or lanceolate in shape, with serrated margins and a leathery texture. The leaves are typically green, turning yellow or orange before shedding in the dry season.

**Flowers:** One of the most distinctive features of *Butea monosperma* is its striking orange to red flowers, which bloom in clusters at the ends of branches. The flowers have a papilionaceous (butterfly-like) structure, with four petals: one large upright standard petal, two lateral wings, and a keel formed by two fused petals. The flowers appear before the leaves, typically in late winter or early spring, creating a spectacular display of color.

**Fruits:** The fruits of *Butea monosperma* are elongated pods, initially green in color and turning brown as they mature. Each pod contains a single seed, hence the species name "*monosperma*," meaning "one seed."

**Roots:** The tree has a deep and extensive root system, which helps it access water and

nutrients from the soil, making it drought-tolerant to some extent.

Habitat: *Butea monosperma* is commonly found in tropical and subtropical regions, growing in a variety of habitats including deciduous forests, scrublands, and along riverbanks. It prefers well-drained soils and can tolerate dry conditions, but it also thrives in areas with periodic rainfall. Overall, *Butea monosperma* is a beautiful and culturally significant tree, valued for its ornamental flowers, timber, and various traditional uses in medicine and dye production.[1-2]

Botanical classification

Kingdom: Plantae (plants)

Subkingdom: Angiosperms (flowering plants)

Superdivision: Eudicots (plants with two seed leaves)

Division: Rosids (plants with certain shared characteristics of their flowers, fruits, and leaves)

Order: Fabales (which includes legumes, pea plants, beans, and other related species)

Family: Fabaceae (the pea family)

Genus: *Butea*

Species: *B. monosperma*

This classification system helps categorize *Butea monosperma* within the broader taxonomy of plant life, indicating its relationships to other species and providing a standardized way to refer to it within the scientific community.[3-4]

Vernacular names of Palash

Plant name: Flame of the forest, Bastard teak

- English: Flame of the forest, Bastard teak

- Hindi: Dhak, Palas

- Assamese: Palash

- Bengali: Palas, Palash Gaccha

- Gujarati: Khakara, Khakda, Khakhado, Khakhar, Khakar, Kesuda

- Kannada: Muttagamara, Muttug, Muttulu

- Konkani: Palash

- Malayalam: Plasu, Pilacham, Palashin, Palash

- Marathi: Palas

- Oriya: Porasur

- Punjabi: Chichara, Dhak, Palas

- Sanskrit: Palash, Kimshuk, Vakrapushpa, Bhramavruksha, Raktapushpa

- Tamil: Palashmaram, Chamata

- Telugu: Modugai, Paladu, Chettu

- Bihari: Faras, Paras

- Kashmiri: Dhak

- Urdu: Dhak, Tesu. [1][4-5]

Synonyms of Palash–

1. Palash: Leaves are beautiful as well as fleshy.

2. Ksharashrestha: Good source of alkali (Kshar).

3. Parna (Leaf): Leaves are useful.

4. Yajniya: Used in religious rituals.

5. Raktapuspa: Flowers are red in color (the color of blood or rakta).

6. Vatapotha: Pacifies vata (constitution).
7. Bijanasha: Seeds (beej) are oily.
8. Vakrapushpa: Its flowers (pushpa) are curved.
9. Krmighna: Potent anthelmintic drug.
10. Kharaparna: Leaf is rough to touch.
11. Putadra: Sacred tree.
12. Samidvara: Uncertain, possibly incomplete or unclear.[3]



Figure 1: Butea monosperma.

### **Chemical constituents of palash:**

Palash, also known as Flame of the Forest or *Butea monosperma*, is a plant native to the Indian subcontinent and Southeast Asia. Various parts of the palash tree, including the bark, leaves, flowers, and seeds, contain different chemical constituents. Some of the notable chemical constituents found in palash include:

1. **Flavonoids:** Palash is rich in flavonoids, such as butein, isobutein, butrin, and isobutrin. These compounds are known for their antioxidant properties and are responsible for the characteristic red-orange color of the flowers.
2. **Terpenoids:** Palash contains terpenoids like betulin, lupeol, and  $\beta$ -sitosterol. Terpenoids have various biological activities, including anti-inflammatory, antimicrobial, and antioxidant properties.
3. **Alkaloids:** Alkaloids such as palasine, isopelletierine, buteinine, and monospermine have been identified in different parts of the palash tree. These alkaloids may possess various pharmacological properties.
4. **Tannins:** Tannins are polyphenolic compounds found in palash bark and leaves. They possess astringent properties and have been traditionally used for their medicinal benefits, including wound healing and diarrhea treatment.
5. **Phenolic compounds:** Palash contains various phenolic compounds, including gallic acid, ellagic acid, and caffeic acid. These compounds contribute to the antioxidant activity of the plant and may have health-promoting effects.
6. **Saponins:** Saponins are glycosides found in palash seeds and other parts of the plant. They have been reported to exhibit antimicrobial, antifungal, and anticancer activities.
7. **Resins and gums:** Palash also contains resins and gums, which may have therapeutic

properties and are often used in traditional medicine systems.

These chemical constituents contribute to the medicinal properties of palash and have been traditionally used for the treatment of various ailments such as inflammation, infections, gastrointestinal disorders, and skin conditions. However, it's essential to consult with a healthcare professional before using palash or its derivatives for therapeutic purposes.[5-6]

### **Phytochemical study or chemical constituents in different parts of the plant:**

A phytochemical study of different parts of the palash plant (*Butea monosperma*) reveals the presence of various chemical constituents. Here's an overview of the chemical constituents found in different parts of the plant:

#### 1. Flowers:

- Flavonoids: Butein, isobutein, butrin, isobutrin
- Anthocyanins: Cyanidin-3-glucoside
- Quercetin glycosides

#### 2. Leaves:

- Flavonoids: Butein, isobutein, butrin, isobutrin
- Triterpenoids: Betulin, lupeol
- Alkaloids: Palasine, isopelletierine

#### 3. Bark:

- Tannins
- Flavonoids: Butein, isobutein
- Alkaloids: Palasine

#### 4. Seeds:

- Alkaloids: Buteinine, monospermine
- Saponins
- Fatty acids

#### 5. Roots:

- Flavonoids: Butein, isobutein
- Triterpenoids
- Steroids - Glycosides

#### 6. Stem:

- Flavonoids: Butein, isobutein
- Triterpenoids

Phytochemical studies have shown that different parts of the palash plant contain a diverse array of bioactive compounds, including flavonoids, alkaloids, tannins, terpenoids, saponins, and phenolic compounds. These compounds contribute to the medicinal properties attributed to the plant, including antioxidant, anti-inflammatory, antimicrobial, and wound-healing activities.

It's important to note that the presence and concentration of these chemical constituents may vary depending on factors such as plant age, environmental conditions, and extraction methods. Further research is needed to explore the full phytochemical profile of palash and its potential pharmacological application

Doses-The dosage form of Palash or *Butea monosperma* can vary depending on how it's being used. Here are some common forms and dosages:

1. Powdered Herb: Palash can be consumed in powdered form. The typical dosage ranges from 1 to 3 grams per day. It can be taken with water or mixed into food.
2. Decoction: A decoction is a concentrated herbal preparation made by boiling the plant material in water. For Palash, you can use around 5-10 grams of dried flowers or bark in 200-300 ml of water. Boil it until the volume reduces by half. The resulting decoction can be consumed once or twice daily, depending on the purpose.
3. Capsules or Tablets: Palash supplements may be available in capsule or tablet form. Follow the instructions on the product label for the recommended dosage, as it can vary depending on the concentration and formulation.
4. Extracts or Tinctures: These concentrated forms of Palash may have different dosages depending on the manufacturer's instructions. It's essential to follow the recommended dosage on the product label or consult with a healthcare provider for guidance.
5. Topical Use: Palash extracts or oils can also be applied topically for certain conditions. The appropriate dosage for topical use may vary, so it's best to follow the instructions provided with the product or seek advice from a healthcare professional.

Always remember to consult with a healthcare provider or an herbalist before using Palash or any herbal remedy, especially if you have underlying health conditions, are pregnant or breastfeeding, or are taking medications that may interact with the herb. [4-5]

### **Formulations and preparations:**

Palash (*Butea monosperma*) is a versatile plant used in various formulations and preparations in traditional medicine. Here are some common formulations and preparations:

1. Powdered Form: The dried flowers, bark, or leaves of Palash can be powdered and used in various ways:
  - Oral Consumption: The powdered form can be mixed with water, honey, or juice and consumed.
  - Topical Application: Palash powder can be mixed with other ingredients like yogurt, milk, or oils to make pastes for topical application.
2. Decoction: Palash decoction is prepared by boiling parts of the plant in water to extract its medicinal properties. This preparation is commonly used for internal consumption:
  - Boil dried Palash flowers, bark, or leaves in water until the volume reduces by half. Strain and consume the liquid as a decoction.
  - Dosage: Typically, 50-100 ml of Palash decoction can be taken once or twice a day, depending on the condition being treated.
3. Infusion: Similar to decoction, an infusion involves steeping plant parts in hot water. This method is suitable for delicate plant materials like leaves or flowers:
  - Steep Palash leaves or flowers in hot water for several minutes. Strain and consume the infused liquid.
4. Oil Infusion: Palash flowers or seeds can be infused into carrier oils to create medicinal oils for topical application:
  - Mix dried Palash flowers or seeds with a carrier oil such as coconut oil or sesame oil. Allow the mixture to infuse for several weeks, then strain the oil.
  - The resulting Palash-infused oil can be applied topically for various skin conditions.
5. Capsules or Tablets: Palash extracts or powdered forms may be encapsulated or

compressed into tablets for convenient consumption:

- Follow the dosage instructions provided on the product label. Dosage may vary depending on the concentration and formulation.
6. Tinctures: Palash tinctures are alcohol-based extracts that concentrate the plant's active compounds:
- Combine dried Palash plant material with alcohol (such as vodka or rum) and let it steep for several weeks. Strain the liquid to obtain the tincture.
  - Tinctures are typically taken in small doses, diluted with water or juice. Follow the dosage instructions provided by a qualified herbalist or healthcare practitioner.

Before using any Palash preparation, it's essential to consult with a qualified healthcare practitioner or herbalist, especially if you have any underlying health conditions or are taking medications. They can provide guidance on the appropriate formulation, dosage, and usage based on your individual needs.[5].

### **Miscellaneous Traditional Uses:**

Palash (*Butea monosperma*) has been traditionally used for various purposes beyond its medicinal properties. Here are some miscellaneous traditional uses:

1. Religious and Cultural Significance: Palash holds significant cultural and religious importance in many regions where it grows. In India, it is associated with Hindu mythology and festivals. The vibrant red or orange flowers are often used in religious ceremonies, rituals, and decorations, especially during festivals like Holi and Durga Puja.
2. Dyeing: The flowers of Palash are used to produce natural dyes. The bright red or orange pigment extracted from the flowers is traditionally used to dye fabrics, such as silk and cotton. These natural dyes are valued for their vibrant colors and eco-friendly properties.
3. Traditional Crafts: Palash flowers and other parts of the plant are sometimes used in traditional crafts. For example, the dried flowers may be incorporated into decorative items like garlands, wreaths, and ornaments. Palash motifs are also used in embroidery, painting, and other forms of artistic expression.
4. Insect Repellent: Various parts of the Palash plant, including the leaves and bark, are believed to have insect-repellent properties. In traditional practices, these parts of the plant may be used to make natural insect repellents or applied directly to repel insects such as mosquitoes.
5. Firewood and Timber: The wood of the Palash tree is used as firewood and for making charcoal. Additionally, it is sometimes used in construction and woodworking for making furniture, agricultural implements, and other wooden objects.
6. Livestock Feed: In some regions, the leaves and pods of the Palash tree are used as fodder for livestock, providing nutrients and forage for grazing animals.
7. Soil Improvement: Palash trees are nitrogen-fixing plants, which means they have the ability to convert atmospheric nitrogen into a form that can be used by plants. As a result, they are sometimes planted in agroforestry systems to improve soil fertility and enhance crop yields.
8. Traditional Medicine Making: Apart from direct medicinal uses, various parts of the Palash plant are sometimes used in traditional medicine formulations for their health-promoting properties. These formulations may include combinations of Palash with other herbs and

ingredients to treat specific ailments or promote overall well-being. These miscellaneous traditional uses highlight the cultural, economic, and ecological significance of Palash in the regions where it is found.[7-8]

### **Products of palash:**

Palash (*Butea monosperma*) is utilized in various products for medicinal, cosmetic, and decorative purposes. Here are some examples of products derived from Palash:

1. **Herbal Supplements:** Palash extracts are often used as an ingredient in herbal supplements, capsules, and tablets. These supplements may be formulated to support various aspects of health, such as immune function, skin health, or overall wellness.
2. **Natural Dyes:** The vibrant red and orange pigments obtained from Palash flowers are used as natural dyes for textiles and fabrics. Palash dye is valued for its eco-friendly properties and is used in the textile industry to color fabrics like silk, cotton, and wool.
3. **Cosmetic Products:** Palash extracts and oils are incorporated into cosmetic formulations such as skincare products, hair care products, and natural dyes for makeup. These products may harness the plant's antioxidant, anti-inflammatory, and moisturizing properties.
4. **Traditional Medicines:** In regions where Palash is traditionally used in herbal medicine, various products may be made from different parts of the plant, including decoctions, infusions, tinctures, and ointments. These products are used to treat a wide range of health conditions, including skin disorders, gastrointestinal issues, and respiratory ailments.
5. **Handicrafts and Decorative Items:** Palash flowers and other plant parts are used in traditional crafts and decorative items. For example, dried Palash flowers may be used to make garlands, wreaths, and ornaments for religious ceremonies, festivals, and home décor.
6. **Natural Insect Repellents:** Extracts from Palash leaves and bark may be used to create natural insect repellents, which are applied to the skin or used in the home to repel mosquitoes and other insects.
7. **Agricultural Products:** Palash leaves and pods can be used as organic fertilizers or mulch to improve soil fertility and enhance crop yields in agriculture.
8. **Charcoal and Firewood:** The wood of the Palash tree is used as firewood and to produce charcoal for fuel.

These are just a few examples of the diverse range of products derived from Palash, highlighting its versatility and importance in various industries and traditional practices.[4]

### **Tree associated with the planet:**

*Butea monosperma*, commonly known as Palash or Flame of the Forest, is associated with the planet- Mars in Vedic astrology. According to traditional beliefs, Mars rules over aspects of the human body such as the heart, blood, brain, and lungs. The various parts of the Palash tree, including its leaves, twigs, stem, bark, roots, and gums, have been used in traditional medicine for centuries.

Palash flowers, in particular, are noted for their medicinal properties. They have been utilized in the treatment of various conditions, including enlarged spleen disorders and menstrual disorders. Additionally, Palash flowers are considered brain stimulants, aiding in cognitive function.

It's important to note that while traditional associations and uses of plants in astrology and



traditional medicine exist, scientific evidence may vary in supporting their efficacy for specific health conditions. Always consult with a qualified healthcare professional before using plants or herbal remedies for medicinal purposes.[9]

**Pharmacological action of different parts of B. monosperma:**

Butea monosperma, also known as Palash or Flame of the Forest, is a plant with various pharmacological actions attributed to its different parts. Here's an overview of the pharmacological actions associated with different parts of Butea monosperma:[10]

Table 1 : Pharmacological activity of butea monosperma (palash)

Plants part	Extract	Pharmacological action
Leaves	Aqueous	Anti-filarial
	Ethanolic	Antidiabetic, antioxidant
	Petroleum ether, chloroform	Anti-inflammatory, anti-oxidant
Flowers	Aqueous	Anticancer, Hepatoprotective effect
	Petroleum	Anticonvulsant
	Ethanolic	Antihyperglycemic, antioxidant potential
	Methanolic	Anti-inflammatory, antioxidant effects, Anti-dopaminergic activity, Free radical scavenging effect
Seed	Alcoholic	Hormone balancing effect
	Methanolic	Antifertility effect, Anthelmintic effect
	Ethanolic	Anti-hyperglycemic and Anti-hyperlipidemic
Barks	Ethanolic	Anti-diarrhoeal, Wound healing activity, Anti-stress
	Methanolic	Osteogenic and Osteoprotective activity, Anti-inflammatory, Effects on hormone level, Anti-ulcer
Fruits	Methanolic	Hypoglycemic effect
	Pippali rasayana	Anthelmintic effect

**Anti- diarrheal activity:**

Butea monosperma, commonly known as Palash or Flame of the Forest, has been investigated for its potential anti-diarrheal activity. Diarrhea is a common gastrointestinal disorder characterized by frequent bowel movements and loose, watery stools. Here's how Butea monosperma exhibits anti-diarrheal activity. the anti-diarrheal effects of an ethanol extract obtained from the stems bark of Butea monosperma (BM) in experimental models.[4],[10],[11],[8],[3],[12],[1],[6]

**Anti-Helminthic Activity :**

Palash, also known as Butea monosperma, is a tree native to the Indian subcontinent and Southeast Asia. It has been traditionally used in Ayurvedic medicine for various therapeutic purposes. While there is limited scientific research specifically on the anti-helminthic (anti-parasitic) activity of palash, some studies suggest that it possesses certain properties that may be effective against helminthic infections.

Here are some potential anti-helminthic properties of palash:

1. Anthelmintic compounds: Palash contains bioactive compounds such as flavonoids, alkaloids, and tannins, which have been shown to possess anthelmintic properties in some studies. These compounds may interfere with the survival, reproduction, or metabolism

of helminths (parasitic worms).

2. Traditional use: In traditional medicine systems like Ayurveda, palash has been used to treat various ailments including parasitic infections. While traditional use doesn't always correlate with scientific efficacy, it can provide a starting point for research into potential therapeutic properties.
3. In vitro studies: Some preliminary in vitro studies have demonstrated the anthelmintic activity of plant extracts containing compounds found in palash against certain types of parasitic worms. These studies suggest that palash and related plant species may have the potential to disrupt the life cycle or viability of helminths.
4. Animal studies: There is limited research on the effects of palash specifically on helminthic infections in animals. However, studies on related plant species or extracts containing similar compounds have shown promising results in reducing worm burden or inhibiting the growth of parasitic worms in animal models.

Despite these potential benefits, further research is needed to fully understand the anti-helminthic activity of palash and its effectiveness in treating helminthic infections in humans. Clinical trials would be necessary to evaluate its safety and efficacy for this purpose. As with any herbal remedy, it's important to use palash under the guidance of a healthcare professional, especially if it's being used to treat a medical condition. [4],[7],[10],[11],[8],[3],[12],[7],[6]

### **Anti-convulsant activity:**

*Butea monosperma*, commonly known as Palash or Flame of the Forest, has been studied for its pharmacological properties, including its potential anti-convulsant activity. Here's an overview of the research findings:

1. Traditional Use: In traditional medicine systems like Ayurveda, *Butea monosperma* has been used to treat various neurological disorders, including epilepsy. While traditional use doesn't always directly correlate with scientific evidence, it can provide a basis for further investigation.
2. Experimental Studies: Several experimental studies have investigated the anti-convulsant properties of *Butea monosperma* extracts or its bioactive constituents using animal models of epilepsy. These studies have shown promising results indicating that *Butea monosperma* may have anti-convulsant effects.
3. Mechanism of Action: The exact mechanism through which *Butea monosperma* exerts its anti-convulsant activity is not fully understood. However, it is believed to involve modulation of neurotransmitter systems, such as gamma-aminobutyric acid (GABA) and glutamate, which play crucial roles in regulating neuronal excitability and seizure activity.
4. Bioactive Compounds: *Butea monosperma* contains various bioactive compounds such as flavonoids, alkaloids, and tannins, which have been implicated in its pharmacological effects, including its potential anti-convulsant activity. These compounds may exert their effects through multiple pathways in the brain.
5. Neuroprotective Effects: Some studies suggest that *Butea monosperma* extracts may also have neuroprotective effects, which could contribute to their potential usefulness in epilepsy management by protecting neurons from damage associated with seizures.

6. **Clinical Evidence:** While there is some preclinical evidence supporting the anti-convulsant activity of *Butea monosperma*, clinical studies in humans are limited. More research is needed to determine the safety and efficacy of *Butea monosperma* or its derivatives as adjunctive or alternative treatments for epilepsy.

Overall, while preliminary research suggests that *Butea monosperma* may possess anti-convulsant properties, further studies are necessary to elucidate its mechanisms of action and establish its clinical utility in the management of epilepsy and other seizure disorders. It's important for individuals considering the use of *Butea monosperma* for seizure control to consult with a healthcare professional for proper guidance and monitoring. [4],[7],[10],[11],[3],[12],[1]

### **Anti-diabetic activity:**

*Butea monosperma*, also known as Flame of the Forest or Palash, is a plant native to the Indian subcontinent and Southeast Asia. It has been traditionally used in Ayurvedic medicine for various purposes, including treating diabetes.

Several studies have investigated the potential anti-diabetic activity of *Butea monosperma*:

1. **Hypoglycemic Activity:** Research has shown that extracts of *Butea monosperma* possess hypoglycemic activity, meaning they can lower blood sugar levels. This effect has been observed in both animal and cell culture studies.
2. **Improved Insulin Sensitivity:** Some studies suggest that *Butea monosperma* may improve insulin sensitivity, which is beneficial for individuals with type 2 diabetes. By enhancing the body's response to insulin, it can help regulate blood sugar levels more effectively.
3. **Antioxidant Properties:** Diabetes is often associated with oxidative stress, which can contribute to complications such as diabetic neuropathy and nephropathy. *Butea monosperma* contains compounds with antioxidant properties, which may help reduce oxidative damage associated with diabetes.
4. **Protection of Pancreatic Beta Cells:** Pancreatic beta cells are responsible for producing insulin. In diabetes, these cells may be damaged or dysfunctional. Some studies suggest that *Butea monosperma* extracts may protect pancreatic beta cells from damage, preserving their function and insulin production capacity.
5. **Reduction of Diabetes-Related Complications:** In addition to its anti-diabetic effects, *Butea monosperma* may also help prevent or alleviate complications associated with diabetes, such as diabetic neuropathy and nephropathy. Its antioxidant and anti-inflammatory properties are thought to contribute to these protective effects.

It's important to note that while these studies suggest potential benefits of *Butea monosperma* for diabetes management, more research is needed to fully understand its mechanisms of action and determine its efficacy and safety in humans. As with any herbal remedy, it's essential to consult with a healthcare professional before using *Butea monosperma*, especially if you have diabetes or are taking medications for it, to avoid potential interactions or adverse effects. [4],[7],[10],[11]

### **Anti-Inflammatory Activity:**

*Butea monosperma*, also known as flame of the forest or palash, is a plant species native to the Indian subcontinent. It has been traditionally used in Ayurvedic medicine for various

purposes, including its anti-inflammatory properties. Several studies have investigated the potential anti-inflammatory activity of *Butea monosperma* extract or its components, with promising results.

Here are some key findings regarding the anti-inflammatory activity of *Butea monosperma*:

1. **Inhibition of Inflammatory Mediators:** Research suggests that *Butea monosperma* extract can inhibit the production of various inflammatory mediators, such as cytokines, prostaglandins, and leukotrienes. These mediators play crucial roles in the inflammatory process, and their suppression can help alleviate inflammation.
2. **Antioxidant Activity:** *Butea monosperma* contains bioactive compounds with antioxidant properties. Oxidative stress is closely linked to inflammation, and antioxidants can help neutralize free radicals and reduce inflammation-associated damage.
3. **Animal Studies:** Several animal studies have demonstrated the anti-inflammatory effects of *Butea monosperma* extracts in various models of inflammation, including carrageenan-induced paw edema and cotton pellet-induced granuloma formation. These studies have shown reductions in inflammatory markers and tissue damage following treatment with *Butea monosperma* extract.
4. **Clinical Studies:** While there is less clinical research compared to preclinical studies, some clinical trials have explored the anti-inflammatory potential of *Butea monosperma* in humans. These trials have mainly focused on conditions such as osteoarthritis and skin inflammation, with preliminary evidence suggesting beneficial effects.
5. **Mechanisms of Action:** The anti-inflammatory mechanisms of *Butea monosperma* may involve modulation of various signaling pathways, including nuclear factor-kappa B (NF- $\kappa$ B), cyclooxygenase (COX), and lipoxygenase (LOX) pathways. By targeting these pathways, *Butea monosperma* can suppress the expression of pro-inflammatory genes and enzymes.

It's important to note that while the existing research suggests potential anti-inflammatory benefits of *Butea monosperma*, more studies, especially well-designed clinical trials, are needed to fully elucidate its efficacy and safety profiles in different inflammatory conditions. Additionally, consulting with a healthcare professional before using *Butea monosperma* or any herbal supplement is advisable, especially for individuals with existing medical conditions or those taking medications. [13] [6],[12],[3],[7],[4],[10],[8]

### **Antifungal activity**

*Butea monosperma*, commonly known as flame of the forest or palash, has been studied for its potential antifungal properties. Research indicates that extracts derived from various parts of the *Butea monosperma* plant exhibit antifungal activity against a range of fungal strains. Here's an overview of its antifungal activity:

1. **In vitro Studies:** Several laboratory studies have demonstrated the antifungal activity of *Butea monosperma* extracts against different fungal species. These studies typically involve testing the efficacy of *Butea monosperma* extracts using methods such as agar diffusion assays or broth dilution assays. Results have shown inhibition of fungal growth, including fungi responsible for common infections like *Candida* spp. and dermatophytes.
2. **Bioactive Compounds:** *Butea monosperma* contains various bioactive compounds, including flavonoids, alkaloids, tannins, and phenolic compounds. These compounds are

known for their antimicrobial properties and are believed to contribute to the antifungal activity of *Butea monosperma* extracts. For example, flavonoids have been shown to disrupt fungal cell membranes and inhibit fungal enzymes.

3. **Mechanisms of Action:** The exact mechanisms underlying the antifungal activity of *Butea monosperma* are not fully understood but may involve multiple pathways. It's suggested that bioactive compounds present in *Butea monosperma* extracts may interfere with fungal cell membrane integrity, disrupt fungal cell wall synthesis, or inhibit fungal enzyme activity crucial for fungal growth and survival.
4. **Clinical Studies:** While there is some preclinical evidence supporting the antifungal activity of *Butea monosperma*, clinical studies evaluating its efficacy in humans are limited. More research is needed to determine the effectiveness of *Butea monosperma* in treating fungal infections in clinical settings.
5. **Traditional Use:** *Butea monosperma* has a history of traditional use in Ayurvedic medicine for various ailments, including fungal infections. While traditional use provides anecdotal evidence of its efficacy, scientific validation through rigorous studies is necessary to confirm its antifungal properties.

In conclusion, while there is promising evidence suggesting the antifungal activity of *Butea monosperma*, further research, especially clinical studies, is needed to fully understand its efficacy, safety, and potential applications in treating fungal infections. As with any herbal remedy, it's essential to consult with a healthcare professional before using *Butea monosperma* for medicinal purposes, especially if you have existing health conditions or are taking medications.[14],[12],[4],[1],[7],[10]

### **Anti-canceractivity**

*Butea monosperma*, also known as Flame of the Forest or Palash, is a plant native to the Indian subcontinent and Southeast Asia. It has been traditionally used in Ayurvedic and folk medicine for various ailments. Research on its potential anti-cancer activity has shown promising results, although further studies are needed to fully understand its mechanisms and efficacy.

Several studies have investigated the anti-cancer properties of *Butea monosperma* extracts and compounds derived from it. Here are some key findings:

1. **Cytotoxic activity:** *Butea monosperma* extracts have been found to exhibit cytotoxic activity against various cancer cell lines, including breast cancer, lung cancer, prostate cancer, and leukemia cells. This cytotoxicity is attributed to the presence of bioactive compounds such as flavonoids, alkaloids, and phenolics.
2. **Apoptotic induction:** Apoptosis, or programmed cell death, is an important mechanism for eliminating cancerous cells. Studies have shown that *Butea monosperma* extracts can induce apoptosis in cancer cells through various pathways, including the activation of caspases, modulation of Bcl-2 family proteins, and generation of reactive oxygen species (ROS).
3. **Anti-inflammatory effects:** Chronic inflammation plays a significant role in the development and progression of cancer. *Butea monosperma* extracts possess anti-inflammatory properties due to the presence of flavonoids and other phytochemicals. By reducing inflammation, these extracts may help inhibit cancer growth and metastasis.

4. **Anti-angiogenic activity:** Angiogenesis, the formation of new blood vessels, is essential for tumor growth and metastasis. Some studies have demonstrated that *Butea monosperma* extracts can inhibit angiogenesis by targeting key angiogenic factors such as vascular endothelial growth factor (VEGF), thereby suppressing tumor vascularization and growth.
5. **Antioxidant effects:** Oxidative stress is implicated in cancer development by promoting DNA damage and mutations. *Butea monosperma* extracts have been shown to possess antioxidant activity, scavenging free radicals and protecting cells from oxidative damage.

While these findings suggest the potential of *Butea monosperma* as a source of anti-cancer agents, more preclinical and clinical studies are needed to evaluate its safety, efficacy, and optimal dosage for cancer treatment. Additionally, further research is required to identify and isolate the specific bioactive compounds responsible for its anti-cancer effects and to elucidate the underlying molecular mechanisms involved.[15],[3],[7],[10],[11],[8]

### **Osteogenic and Osteoprotective**

*Butea monosperma*, also known as Flame of the Forest or Palash, is a plant native to the Indian subcontinent and Southeast Asia. It has been traditionally used in Ayurvedic medicine for various purposes, including treating bone-related disorders. While there's limited scientific research specifically focusing on the osteogenic (bone-forming) and osteoprotective (bone-protecting) activities of *Butea monosperma*, some studies suggest its potential in this regard.

1. **Anti-inflammatory Properties:** Inflammation plays a crucial role in bone disorders such as osteoporosis. *Butea monosperma* has been found to possess anti-inflammatory properties, which may contribute to its potential osteoprotective effects by reducing inflammation-induced bone loss.
2. **Phytoestrogenic Activity:** Some research suggests that *Butea monosperma* may exhibit phytoestrogenic activity. Phytoestrogens are plant-derived compounds that mimic the effects of estrogen in the body. Estrogen plays a significant role in bone metabolism and helps maintain bone density. Therefore, phytoestrogens from *Butea monosperma* may contribute to its osteoprotective activity, especially in conditions like osteoporosis.
3. **Mineralization:** Studies have shown that extracts of *Butea monosperma* may promote mineralization of bone cells *in vitro*. This suggests a potential role in enhancing bone formation and mineralization, indicating osteogenic activity.
4. **Animal studies:** Some animal studies have demonstrated the bone-strengthening effects of *Butea monosperma* extracts. These studies often involve administering *Butea monosperma* extract to animals with induced bone disorders or deficiencies, showing improvements in bone density, strength, and structure.
5. **Clinical Evidence:** While there's limited clinical evidence specifically examining the osteogenic and osteoprotective effects of *Butea monosperma* in humans, traditional usage and some preliminary studies indicate its potential benefits. Further clinical research is needed to validate these effects and determine the optimal dosage and administration for therapeutic purposes.

Overall, while *Butea monosperma* shows promise as a natural remedy for bone-related disorders, more research, particularly human clinical trials, is necessary to fully understand its mechanisms of action and therapeutic potential in promoting bone health. As with any herbal

remedy, it's essential to consult with a healthcare professional before using *Butea monosperma* for medicinal purposes, especially if you have existing medical conditions or are taking medications.[16],[3],[7],[10],[15]

### **Anti mycobacterial activity**

*Butea monosperma*, also known as Flame of the Forest or Palash, is a tree native to the Indian subcontinent. Various parts of this plant have been traditionally used in Ayurvedic medicine for their therapeutic properties. While research on the anti-mycobacterial activity of *Butea monosperma* is relatively limited compared to more extensively studied medicinal plants, there are some studies suggesting its potential in this regard.

Here are some findings regarding the anti-mycobacterial activity of *Butea monosperma*:

1. **In vitro studies:** Several studies have investigated the anti-mycobacterial potential of extracts derived from different parts of *Butea monosperma*. These studies typically involve testing the extracts against various strains of *Mycobacterium tuberculosis*, the bacterium responsible for tuberculosis. Results from these studies have shown that certain extracts of *Butea monosperma* possess inhibitory effects against the growth of *Mycobacterium tuberculosis* in laboratory settings.
2. **Phytochemical analysis:** Phytochemical analysis of *Butea monosperma* extracts has revealed the presence of various bioactive compounds, including flavonoids, tannins, alkaloids, and phenolic compounds. Some of these compounds have been reported to exhibit antimicrobial properties, which could contribute to the observed anti-mycobacterial activity.
3. **Animal studies:** While there is limited research on animal models regarding the anti-mycobacterial activity of *Butea monosperma*, some studies have demonstrated promising results. These studies typically involve infecting animals with *Mycobacterium tuberculosis* and then administering *Butea monosperma* extracts to evaluate their effects on the progression of the infection. Results from such studies have shown reductions in bacterial load and improvement in disease outcomes in animals treated with *Butea monosperma* extracts.
4. **Mechanism of action:** The exact mechanism underlying the anti-mycobacterial activity of *Butea monosperma* is not fully understood and requires further investigation. However, it is believed that the bioactive compounds present in the plant extracts may interfere with various cellular processes of the bacteria, leading to inhibition of growth and proliferation.

Overall, while there is promising evidence suggesting the anti-mycobacterial potential of *Butea monosperma*, further research is needed to elucidate its mechanism of action, optimize extraction methods, identify active compounds, and evaluate its efficacy and safety in clinical settings.[17],[3],[7],[8]

### **Anti-stress Activity**

The anti-stress activity of *Butea monosperma* has been investigated in traditional medicine systems, particularly in Ayurveda. While scientific research on this specific aspect is limited compared to other more extensively studied medicinal properties of the plant, there is some evidence suggesting its potential anti-stress effects. Here's an overview:

1. **Adaptogenic properties:** Butea monosperma is considered an adaptogen in Ayurveda, meaning it may help the body adapt to stress and maintain homeostasis. Adaptogens are substances that are believed to enhance the body's resilience to physical and mental stressors without causing significant side effects. While there's anecdotal evidence supporting this traditional use, scientific studies validating its adaptogenic properties are limited.
2. **Phytochemical composition:** Butea monosperma contains various bioactive compounds, including flavonoids, phenolic compounds, alkaloids, and terpenoids. Some of these compounds have been studied for their potential to modulate stress response pathways in the body. For example, flavonoids and phenolic compounds possess antioxidant properties and may help reduce oxidative stress, which is associated with various stress-related disorders.
3. **Animal studies:** Some animal studies have investigated the effects of Butea monosperma extracts on stress-related parameters. These studies typically involve inducing stress in laboratory animals (such as rodents) and then administering Butea monosperma extracts to evaluate their effects on stress biomarkers, behavior, and physiological responses. While results from these studies have shown promising outcomes, more research is needed to confirm and understand the underlying mechanisms.
4. **Traditional use:** In traditional medicine practices like Ayurveda, Butea monosperma has been used for its calming and relaxing properties. It is often incorporated into formulations aimed at reducing stress, anxiety, and promoting overall well-being. However, traditional use alone does not provide conclusive evidence of its efficacy, and scientific validation is essential.
5. **Human studies:** Clinical trials evaluating the anti-stress effects of Butea monosperma in humans are scarce. More research is needed to assess its safety, efficacy, and optimal dosage in human populations.

While there's some evidence suggesting the potential anti-stress activity of Butea monosperma, further well-designed studies are necessary to establish its effectiveness, mechanisms of action, and safety profile. Additionally, it's essential to consult healthcare professionals before using herbal remedies for managing stress or any other health condition, especially if you have underlying medical issues or are taking medications.[18],[4],[10],[11],[8],[14]

### **Hepatoprotective activity**

The hepatoprotective activity of Butea monosperma has been a subject of interest in both traditional medicine systems and modern scientific research. Hepatoprotective agents are substances that help protect the liver from damage and promote its regeneration. Here's an overview of the hepatoprotective activity of Butea monosperma:

1. **Traditional use:** In traditional medicine systems like Ayurveda, various parts of the Butea monosperma plant, including leaves, bark, flowers, and seeds, have been used for their hepatoprotective properties. These traditional uses provide a basis for further investigation into the plant's potential benefits for liver health.
2. **Phytochemical composition:** Butea monosperma contains several bioactive compounds, including flavonoids, phenolic compounds, tannins, alkaloids, and terpenoids. Some of



these compounds have demonstrated hepatoprotective effects in scientific studies. For example, flavonoids and phenolic compounds exhibit antioxidant properties, which can help reduce oxidative stress and inflammation in the liver.

3. **Antioxidant activity:** Oxidative stress is known to play a significant role in liver damage and disease. Studies have shown that *Butea monosperma* extracts possess antioxidant activity, which can help neutralize harmful free radicals and protect liver cells from oxidative damage.
4. **Anti-inflammatory activity:** Inflammation is another key factor in liver injury and disease progression. *Butea monosperma* has been reported to exhibit anti-inflammatory properties, which may help reduce inflammation in the liver and prevent further damage.
5. **Experimental studies:** Several experimental studies have investigated the hepatoprotective activity of *Butea monosperma* using animal models of liver injury induced by toxins, drugs, or other hepatotoxic agents. These studies have shown that treatment with *Butea monosperma* extracts can help prevent liver damage, improve liver function tests, reduce markers of liver injury, and promote liver regeneration.
6. **Mechanisms of action:** The hepatoprotective mechanisms of *Butea monosperma* are thought to involve a combination of antioxidant, anti-inflammatory, and other biochemical pathways. These mechanisms may include scavenging free radicals, inhibiting inflammation, enhancing detoxification enzymes, and promoting liver cell repair and regeneration.

While the existing evidence suggests the hepatoprotective potential of *Butea monosperma*, more research is needed to fully understand its mechanisms of action, optimal dosage, safety profile, and potential clinical applications in humans. Clinical trials in humans are particularly essential to validate its effectiveness and safety for liver health. As with any herbal remedy, it's crucial to consult with a healthcare professional before using *Butea monosperma* for liver-related issues, especially if you have existing liver conditions or are taking medications.[19]

### **Antihyperglycemic activity:**

*Butea monosperma* has been investigated for its potential antihyperglycemic activity, particularly in the context of managing diabetes mellitus. Antihyperglycemic agents are substances that help lower blood glucose levels, which is crucial for managing diabetes and preventing associated complications. Here's an overview of the antihyperglycemic activity of *Butea monosperma*:

1. **Traditional use:** In traditional medicine systems like Ayurveda, various parts of the *Butea monosperma* plant have been used for their medicinal properties, including in the management of diabetes. While traditional use provides anecdotal evidence, modern scientific research aims to validate these claims and understand the mechanisms involved.
2. **Phytochemical composition:** *Butea monosperma* contains bioactive compounds such as flavonoids, phenolic compounds, tannins, alkaloids, and terpenoids. Some of these compounds have been studied for their potential antihyperglycemic effects. For example, flavonoids and phenolic compounds may improve insulin sensitivity, enhance glucose uptake by cells, and inhibit carbohydrate-digesting enzymes, thereby helping to regulate blood glucose levels.
3. **Experimental studies:** Several preclinical studies have investigated the antihyperglycemic

activity of *Butea monosperma* extracts using animal models of diabetes. These studies have shown that treatment with *Butea monosperma* extracts can lead to reductions in blood glucose levels, improvements in insulin sensitivity, and modulation of various biochemical parameters associated with diabetes.

4. Mechanisms of action: The mechanisms underlying the antihyperglycemic activity of *Butea monosperma* are multifaceted and may involve various pathways. Some proposed mechanisms include:
  - Enhancement of insulin secretion from pancreatic beta cells.
  - Improvement of insulin sensitivity in peripheral tissues, such as muscle and adipose tissue.
  - Inhibition of carbohydrate-digesting enzymes, such as alpha-amylase and alpha-glucosidase, leading to reduced glucose absorption from the intestine.
  - Protection against oxidative stress and inflammation, which are associated with insulin resistance and diabetes complications.
5. Human studies: While most of the evidence supporting the antihyperglycemic activity of *Butea monosperma* comes from animal studies, there is a lack of well-controlled human clinical trials evaluating its efficacy and safety in diabetic patients. More research is needed to determine the optimal dosage, duration of treatment, and potential side effects in human populations.

Overall, while preliminary studies suggest the potential antihyperglycemic activity of *Butea monosperma*, further research, particularly in humans, is warranted to confirm its effectiveness and safety for managing diabetes mellitus. As with any herbal remedy, it's essential to consult with a healthcare professional before using *Butea monosperma* for diabetes management, especially if you are already taking medications for diabetes or other health conditions.[20]

### **Antioxidant activity:**

*Butea monosperma*, commonly known as Flame of the Forest or Palash, is a tree native to the Indian subcontinent and Southeast Asia. Various parts of the *Butea monosperma* tree, including its leaves, flowers, bark, and seeds, have been traditionally used in Ayurvedic medicine for their medicinal properties.

Several studies have investigated the antioxidant activity of different parts of the *Butea monosperma* tree, particularly its leaves, flowers, and seeds. These studies have revealed that *Butea monosperma* exhibits significant antioxidant potential, which can be attributed to the presence of various phytochemicals such as flavonoids, phenolic compounds, tannins, and terpenoids.

Research on the antioxidant activity of *Butea monosperma* has demonstrated its ability to scavenge free radicals, inhibit lipid peroxidation, and protect against oxidative stress-induced damage in vitro. Additionally, animal studies have shown that extracts from *Butea monosperma* possess antioxidant properties and can help reduce oxidative stress markers in tissues and organs.

Furthermore, the antioxidant activity of *Butea monosperma* may contribute to its various pharmacological effects, including anti-inflammatory, antimicrobial, hepatoprotective, neuroprotective, and anticancer properties.

However, it's essential to conduct further research, including human clinical trials, to fully understand the antioxidant mechanisms of *Butea monosperma* and its potential health benefits in preventing or treating oxidative stress-related diseases. Additionally, the dosage, bioavailability, and safety profile of *Butea monosperma* extracts need to be evaluated to ensure their efficacy and safety for human consumption or medicinal use.[21]

### **Hemagglutinating activity:**

Hemagglutination refers to the process where red blood cells clump together due to certain substances. Hemagglutinating activity can be found in various sources including plants. *Butea monosperma*, also known as "flame of the forest" or "bastard teak," is a plant native to South Asia, particularly India and Sri Lanka.

Studies have investigated the hemagglutinating activity of *Butea monosperma*. Hemagglutinins are proteins that can cause agglutination of red blood cells. These proteins have been found in various parts of the plant including seeds, leaves, and flowers.

One study published in the journal "Pharmacognosy Research" in 2014 evaluated the hemagglutinating activity of *Butea monosperma* seeds. The study found that the seeds contain lectins, which are proteins capable of causing agglutination of red blood cells. The hemagglutinating activity was dose-dependent, meaning that higher concentrations of the seed extract resulted in stronger agglutination of red blood cells.

Another study published in the "International Journal of Pharmaceutical Sciences and Research" in 2013 investigated the hemagglutinating activity of various parts of the *Butea monosperma* plant, including seeds, leaves, and flowers. The study found that all parts of the plant exhibited hemagglutinating activity, with the highest activity observed in the seeds.

Overall, these studies indicate that *Butea monosperma* possesses hemagglutinating activity, primarily attributed to the presence of lectins in its seeds, leaves, and flowers. Further research may be needed to explore the potential applications of these hemagglutinins in various fields such as medicine, biotechnology, or diagnostics.[22]

### **Anti-Giardiasis activity:**

*Butea monosperma*, commonly known as the flame-of-the-forest or palash tree, is a plant native to the Indian subcontinent. Traditionally, various parts of this tree, including its leaves, flowers, and bark, have been used in Ayurvedic and traditional medicine for their medicinal properties.

While there is limited scientific research specifically investigating the anti-giardiasis activity of *Butea monosperma*, several studies have explored its pharmacological properties, including its antimicrobial effects.

1. **Antimicrobial Activity:** Some studies have demonstrated the antimicrobial properties of *Butea monosperma* extracts against a range of pathogens, including bacteria and fungi. These antimicrobial properties suggest that *Butea monosperma* may have the potential to inhibit the growth of parasites like *Giardia lamblia*, the causative agent of giardiasis.
2. **Antioxidant Activity:** *Butea monosperma* is also known to possess antioxidant properties due to the presence of bioactive compounds such as flavonoids and phenolic compounds. Antioxidants can help in combating oxidative stress, which plays a role in various infectious diseases, including giardiasis.

3. **Anti-inflammatory Activity:** Some studies suggest that *Butea monosperma* extracts exhibit anti-inflammatory effects. Inflammation is a crucial component of the host response to parasitic infections, and compounds with anti-inflammatory properties may help alleviate symptoms associated with giardiasis.
4. **Traditional Use:** Although not a scientific evidence, traditional medicinal systems like Ayurveda have employed *Butea monosperma* for treating various gastrointestinal disorders. This traditional use hints at its potential effectiveness against parasitic infections like giardiasis.

While these findings suggest that *Butea monosperma* may possess properties that could be beneficial in the treatment of giardiasis, further research, particularly clinical trials, is needed to confirm its efficacy and safety for this specific indication. Additionally, the active constituents responsible for its potential anti-giardiasis activity need to be identified and studied further for their mechanism of action.[23]

### **Antimicrobial activity:**

*Butea monosperma*, commonly known as "Flame of the Forest" or "Palash," is a species of flowering plant native to the Indian subcontinent. Various parts of this plant, including its bark, leaves, flowers, and seeds, have been traditionally used in Ayurvedic and folk medicine for their medicinal properties. Several studies have investigated the antimicrobial activity of different parts of *Butea monosperma*:

1. **Leaf Extracts:** Research suggests that leaf extracts of *Butea monosperma* possess significant antimicrobial properties. Studies have shown inhibitory effects against various pathogenic bacteria and fungi. These effects are attributed to the presence of bioactive compounds such as flavonoids, alkaloids, and tannins.
2. **Bark Extracts:** Extracts derived from the bark of *Butea monosperma* have also demonstrated antimicrobial activity. They have been reported to exhibit inhibitory effects against both Gram-positive and Gram-negative bacteria, as well as certain fungal strains. These antimicrobial properties are thought to be due to the presence of phenolic compounds and other secondary metabolites.
3. **Flower Extracts:** The flowers of *Butea monosperma* have been found to possess antimicrobial properties as well. Studies have shown their effectiveness against various bacterial and fungal pathogens. Phytochemical analysis has revealed the presence of flavonoids, saponins, and other bioactive compounds in flower extracts, which contribute to their antimicrobial activity.
4. **Seed Extracts:** Although less studied compared to other parts of the plant, seed extracts of *Butea monosperma* have also shown promising antimicrobial activity. Research indicates their effectiveness against certain bacterial strains, suggesting their potential application in combating microbial infections.

Overall, *Butea monosperma* exhibits significant antimicrobial activity across its various parts, making it a subject of interest for further exploration in the development of natural antimicrobial agents. However, more research is needed to fully understand the mechanisms of action and to assess its potential for clinical use.[24]

### **Anti-gout Activity:**

Gout is a form of arthritis caused by the buildup of uric acid crystals in the joints, leading to inflammation and severe pain. While research specifically focusing on the anti-gout activity of *Butea monosperma* (Flame of the Forest) is limited, the plant's traditional use in Ayurvedic and folk medicine suggests potential therapeutic effects for gout and related conditions. Here's an overview of how *Butea monosperma* might exert anti-gout activity:

1. **Anti-inflammatory Properties:** *Butea monosperma* has been reported to possess significant anti-inflammatory properties. Inflammation is a key component of gout, and substances with anti-inflammatory activity can help alleviate symptoms such as pain and swelling associated with gout attacks.
2. **Antioxidant Activity:** Oxidative stress is implicated in the progression of gout and the associated inflammation. *Butea monosperma* contains various phytochemicals such as flavonoids and phenolic compounds, which exhibit antioxidant properties. These antioxidants may help reduce oxidative damage and inflammation in the joints, potentially mitigating gout symptoms.
3. **Uric Acid Regulation:** Some studies suggest that certain plant compounds may influence uric acid metabolism. While specific mechanisms related to *Butea monosperma* are not well elucidated, it's possible that components of the plant could modulate uric acid levels, either by inhibiting uric acid production or promoting its excretion, thereby reducing the risk of gout attacks.
4. **Analgesic Effects:** In traditional medicine systems, *Butea monosperma* is also known for its analgesic properties. While gout primarily manifests with joint pain, the analgesic effects of *Butea monosperma* may help alleviate discomfort associated with gout attacks.
5. **Immunomodulatory Activity:** *Butea monosperma* extracts have been investigated for their immunomodulatory effects. Modulating the immune response may help reduce inflammation and improve symptoms in conditions like gout where the immune system plays a significant role in the pathogenesis.

While these potential mechanisms suggest that *Butea monosperma* could have beneficial effects in managing gout, rigorous scientific studies, including clinical trials, are necessary to validate its efficacy and safety for this specific indication. Furthermore, it's essential to consult with healthcare professionals before using any herbal remedies, including *Butea monosperma*, especially in the context of managing chronic conditions like gout.[25]

### **Anti-ulcer activity:**

*Butea monosperma*, also known as the flame-of-the-forest or palash, is a plant native to the Indian subcontinent and Southeast Asia. It has been traditionally used in various medicinal preparations for its potential health benefits. One area of interest is its anti-ulcer activity.

Research suggests that *Butea monosperma* possesses certain properties that may contribute to its anti-ulcer effects:

1. **Anti-inflammatory Properties:** Inflammation plays a significant role in the development of ulcers. *Butea monosperma* contains compounds with anti-inflammatory properties, which can help in reducing inflammation in the gastrointestinal tract and preventing ulcer formation.
2. **Antioxidant Activity:** Oxidative stress is another factor implicated in the development of

ulcers. *Butea monosperma* is rich in antioxidants, such as flavonoids and phenolic compounds, which can neutralize free radicals and protect the gastric mucosa from oxidative damage.

3. **Cytoprotective Effects:** Some studies have indicated that *Butea monosperma* extracts may possess cytoprotective effects on the gastric mucosa. This means that it can maintain the integrity of the stomach lining and preventing damage that could lead to ulcer formation.
4. **Mucosal Healing:** *Butea monosperma* extracts have been reported to promote the healing of gastric ulcers by enhancing the regeneration of gastric mucosal cells and increasing the production of mucus, which serves as a protective barrier for the stomach lining.
5. **Acid-Suppressive Effects:** *Butea monosperma* may also exhibit mild acid-suppressive effects, which can help in reducing gastric acid secretion and acidity, thereby preventing the exacerbation of ulcers.

However, it's important to note that while there is some scientific evidence supporting the anti-ulcer activity of *Butea monosperma*, further research, including clinical trials, is needed to fully understand its mechanism of action and potential therapeutic benefits in the treatment of ulcers. Additionally, the use of *Butea monosperma* or its extracts for medicinal purposes should be done under the guidance of a healthcare professional to ensure safety and efficacy.[26]

### **Antidopaminergic activity:**

Antidopaminergic activity refers to the ability of a substance to block or inhibit the action of dopamine, a neurotransmitter in the brain. Dopamine plays a crucial role in various physiological functions, including movement, emotion, reward, and pleasure. Antidopaminergic agents are often used in the treatment of conditions such as psychosis, schizophrenia, and certain gastrointestinal disorders.

There is limited scientific literature specifically discussing the antidopaminergic activity of *Butea monosperma*. Most of the research on this plant has focused on its antioxidant, anti-inflammatory, anti-ulcer, and other pharmacological activities, rather than its effects on dopamine receptors or neurotransmission.

However, it's worth noting that some plants contain compounds that may have indirect effects on dopamine levels or dopamine receptor activity. For example, certain flavonoids and alkaloids found in plants have been shown to interact with dopaminergic pathways in the brain, although their effects may not be as potent or specific as those of pharmaceutical dopaminergic agents.

To ascertain whether *Butea monosperma* exhibits antidopaminergic activity, further research, including *in vitro* and *in vivo* studies, would be necessary. These studies would involve investigating the plant's effects on dopamine receptors, dopamine levels in the brain, and behavioral responses related to dopamine function. Until such research is conducted, it's challenging to conclusively state whether *Butea monosperma* possesses antidopaminergic activity.[27]

### **Anticonceptive activity:**

As of my last update in January 2022, there is limited scientific evidence regarding the

contraceptive activity of *Butea monosperma*. While this plant has been traditionally used in various medicinal preparations, including those related to reproductive health, research specifically focused on its contraceptive effects is scarce. However, some plants have been found to possess certain contraceptive properties due to their effects on hormonal levels, sperm motility, or implantation. *Butea monosperma* may contain compounds with similar potential, but specific studies on its contraceptive activity are lacking.

It's important to approach traditional remedies and herbal medicines with caution, especially regarding contraception, as their efficacy and safety profiles are often not well-established through rigorous scientific research and clinical trials.

If you're considering using *Butea monosperma* or any other herbal remedy for contraception, it's crucial to consult with a healthcare professional for personalized advice and to explore safe and effective contraceptive options that have been thoroughly studied and approved. [28-29]

### **Anti-asthmatic activity:**

As of my last update in January 2022, research specifically focusing on the anti-asthmatic activity of *Butea monosperma* is limited. However, some studies have investigated its potential effects on respiratory health due to its anti-inflammatory and bronchodilatory properties.

1. **Anti-inflammatory activity:** Inflammation plays a significant role in the pathogenesis of asthma. Compounds found in *Butea monosperma*, such as flavonoids and phenolic compounds, have been shown to possess anti-inflammatory properties. These compounds may help reduce inflammation in the airways, potentially alleviating symptoms of asthma.
2. **Bronchodilatory effects:** Asthma is characterized by airway constriction, leading to symptoms such as wheezing, coughing, and shortness of breath. Some plant extracts, including those from *Butea monosperma*, have been reported to exhibit bronchodilatory effects, which can help relax the smooth muscles in the airways and improve airflow.
3. **Antioxidant properties:** Oxidative stress is implicated in the inflammation and airway hyperresponsiveness seen in asthma. *Butea monosperma* contains antioxidants that may help neutralize free radicals and reduce oxidative damage in the airways, potentially mitigating asthma symptoms.

While these mechanisms suggest that *Butea monosperma* could have potential as an anti-asthmatic agent, more research is needed to evaluate its efficacy and safety for this purpose. Clinical trials involving human subjects are necessary to determine whether *Butea monosperma* extracts or compounds derived from the plant could be used as adjunctive therapy or alternative treatments for asthma. If you're considering using *Butea monosperma* or any herbal remedy for asthma management, it's important to consult with a healthcare professional. They can provide guidance tailored to your specific condition and help you navigate safe and effective treatment options.

### **Wound healing activity:**

*Butea monosperma*, also known as Flame of the Forest or Palash, is a tree native to the Indian subcontinent. Various parts of this plant, including leaves, flowers, seeds, and bark, have been

traditionally used in Ayurvedic medicine for their medicinal properties, including wound healing.

Several studies have explored the wound healing activity of *Butea monosperma*, particularly focusing on its extracts and compounds. Here are some key findings:

1. **Anti-inflammatory Activity:** *Butea monosperma* exhibits significant anti-inflammatory properties, which are crucial for wound healing. Inflammation is a necessary part of the healing process, but excessive inflammation can delay wound closure. Compounds present in *Butea monosperma* help in reducing inflammation at the wound site, thus promoting faster healing.
2. **Antioxidant Activity:** The plant is rich in antioxidants that scavenge free radicals and reduce oxidative stress at the wound site. Oxidative stress can impair wound healing by damaging cells and interfering with the normal healing process. Antioxidants in *Butea monosperma* protect cells from oxidative damage, facilitating better wound repair.
3. **Collagen Synthesis:** Collagen is a key protein involved in wound healing, providing structural support to the newly formed tissue. Studies suggest that *Butea monosperma* extracts promote collagen synthesis, thereby accelerating the formation of granulation tissue and wound closure.
4. **Angiogenesis:** Angiogenesis, the process of new blood vessel formation, is essential for supplying oxygen and nutrients to the healing wound. Compounds found in *Butea monosperma* have been shown to stimulate angiogenesis, enhancing blood flow to the wound area and promoting faster healing.
5. **Antimicrobial Activity:** Wounds are susceptible to infections, which can impede the healing process. *Butea monosperma* possesses antimicrobial properties that help prevent bacterial colonization of the wound site, reducing the risk of infection and supporting uninterrupted healing.
6. **Promotion of Epithelialization:** Epithelialization is the final stage of wound healing, where the wound is covered by new epithelial cells. Extracts of *Butea monosperma* have been found to accelerate this process, leading to complete wound closure. It's important to note that while these findings are promising, further research, including clinical trials, is needed to validate the efficacy and safety of *Butea monosperma* for wound healing in humans. Additionally, proper dosage, formulation, and mode of application need to be standardized for optimal therapeutic outcomes. As with any herbal remedy, consulting a healthcare professional before use is advisable, especially if one is already undergoing medical treatment or has pre-existing health conditions.[30]

### **Diuretic activity:**

*Butea monosperma*, also known as Flame of the Forest or Palash, is a plant species native to parts of South Asia, particularly India and Bangladesh. Traditionally, various parts of this plant, including its flowers, leaves, bark, and seeds, have been used in traditional medicine systems like Ayurveda for their potential medicinal properties.

Regarding diuretic activity, there is limited scientific research specifically focusing on *Butea monosperma*'s diuretic effects. However, some studies have investigated its potential pharmacological properties, which might indirectly relate to diuretic activity.

1. **Anti-inflammatory properties:** Some studies suggest that *Butea monosperma* possesses



anti-inflammatory properties. Inflammation plays a role in various renal conditions, and substances with anti-inflammatory effects might influence renal function, potentially affecting diuresis.[31]

2. **Antioxidant activity:** Butea monosperma contains compounds with antioxidant properties. Antioxidants may have a protective effect on the kidneys and could indirectly affect diuresis.
3. **Traditional use:** In traditional medicine systems like Ayurveda, Butea monosperma is sometimes used for conditions related to urinary health. While traditional use doesn't always directly correlate with scientific evidence, it suggests that this plant might have effects on urinary function, which could include diuresis.
4. **Phytochemical constituents:** Butea monosperma contains various bioactive compounds, including flavonoids, phenols, tannins, and alkaloids. Some of these compounds have been associated with diuretic activity in other plants.

However, it's essential to note that scientific evidence directly investigating the diuretic effects of Butea monosperma is lacking. More research, including preclinical and clinical studies, would be necessary to confirm and understand its potential diuretic activity fully. Additionally, while herbal remedies can offer benefits, they can also have side effects or interactions with medications. Therefore, it's crucial to consult healthcare professionals before using Butea monosperma or any herbal remedy for medicinal purposes.[32]

### **Free radical scavenging activity:**

Butea monosperma, commonly known as Flame of the Forest or Palash, has been studied for its antioxidant properties, which are closely related to free radical scavenging activity. Free radicals are unstable molecules that can cause damage to cells and contribute to various diseases, including cancer, cardiovascular diseases, and neurodegenerative disorders. Antioxidants help neutralize these free radicals, thereby protecting cells from oxidative damage.

Several studies have investigated the antioxidant and free radical scavenging activities of Butea monosperma, primarily focusing on its various parts such as leaves, flowers, bark, and seeds. Here are some findings from scientific research.[33]

### **Cultivation of butea monosperma:**

Butea monosperma, also known as the flame-of-the-forest or palash, is a species of flowering tree native to the Indian subcontinent. It is often cultivated for its ornamental value, medicinal properties, and use in traditional rituals. Here are some general guidelines for cultivating Butea monosperma:

1. **Climate:** Butea monosperma thrives in tropical and subtropical climates. It prefers full sunlight and well-drained soil.
2. **Soil:** The tree can tolerate a variety of soil types, including sandy, loamy, and clay soils, but it grows best in fertile, well-drained soil with a pH range of 5.0 to 8.0.
3. **Propagation:** Butea monosperma can be propagated from seeds or by stem cuttings. Seeds should be planted in pots or directly in the ground during the rainy season. Germination usually occurs within 15-30 days. Stem cuttings should be taken from mature trees and planted in a rooting medium until they develop roots.

4. **Planting:** When planting seeds or seedlings, ensure proper spacing between plants to allow for growth. Planting holes should be dug to accommodate the root system, and the soil should be backfilled around the roots, ensuring the tree is planted at the same depth as it was in the nursery container.
5. **Watering:** While *Butea monosperma* is drought-tolerant once established, it benefits from regular watering, especially during dry periods or in the early stages of growth. However, it is important not to overwater, as this can lead to root rot.
6. **Fertilization:** Apply organic compost or well-decomposed manure around the base of the tree annually to provide essential nutrients for growth and flowering.
7. **Pruning:** Prune *Butea monosperma* to remove dead or diseased branches and to shape the tree as desired. Pruning should be done during the dormant season to minimize stress on the tree.
8. **Pests and Diseases:** *Butea monosperma* is relatively resistant to pests and diseases. However, occasional pest problems such as aphids or scale insects may occur, which can be treated with insecticidal soap or neem oil.
9. **Support:** Young *Butea monosperma* trees may benefit from staking to provide support until they are well-established.
10. **Harvesting:** The tree typically starts flowering when it is 3-5 years old. Flowers bloom in clusters and are bright orange-red in color. While *Butea monosperma* is primarily grown for ornamental purposes, the flowers are also used in traditional medicine and for dyeing purposes.

By following these guidelines, you can successfully cultivate *Butea monosperma* and enjoy its beauty in your garden or landscape.[34]

### **Chemistry:**

*Butea monosperma*, commonly known as Palash or Flame of the Forest, contains various phytochemicals that contribute to its medicinal properties. Here are some of the key compounds found in different parts of the plant:

1. **Flavonoids:**

Butein, Isobutein, Butrin, Isobutrin, Sulfuretin

2. **Chalcones:**

Butein, Isobutein

3. **Terpenoids:**

Beta-sitosterol, Lupeol

4. **Alkaloids**

5. **Phenolic Compounds:**

Gallic acid, Catechin, Epicatechin

6. **Tannins.**

7. **Glycosides.**

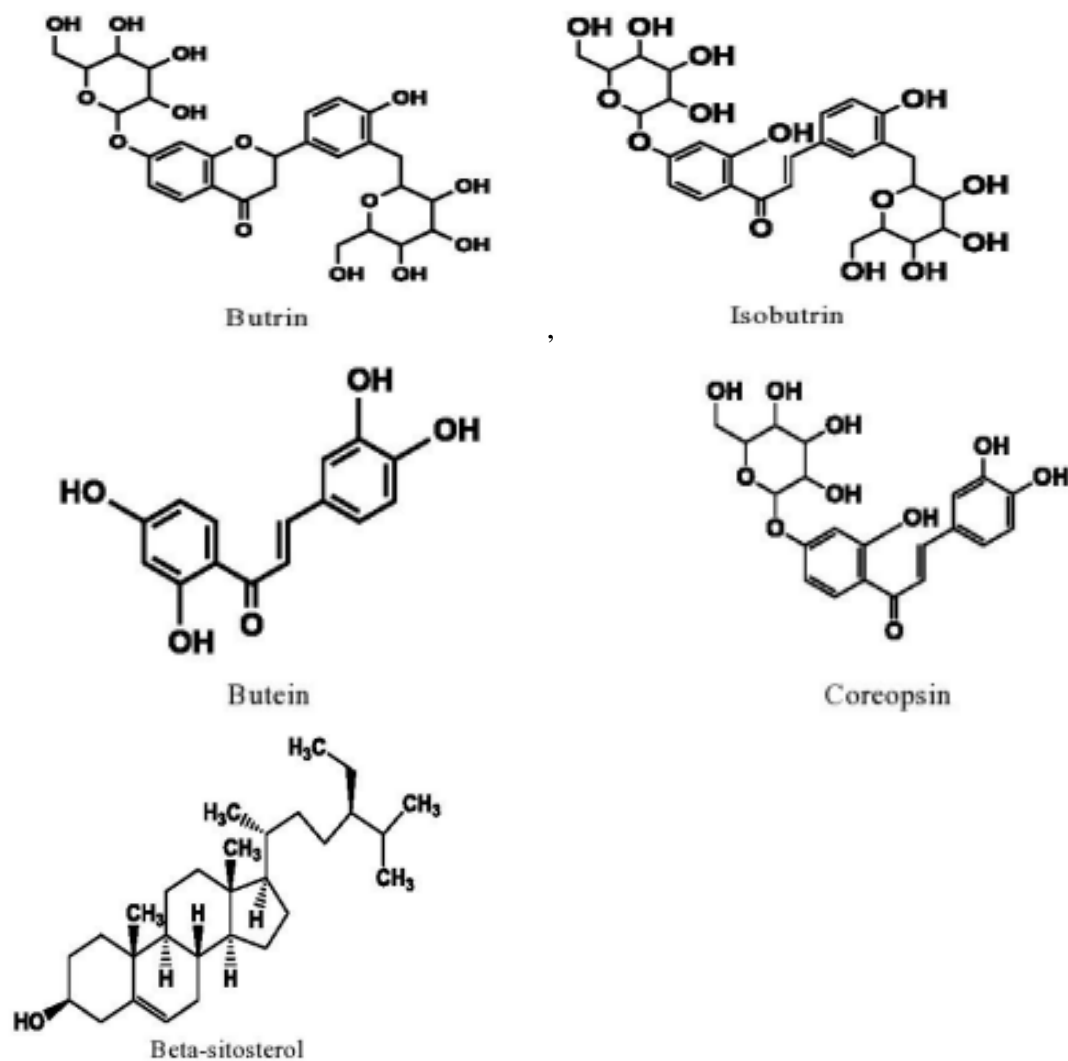


Fig 2- Chemical structure of the biologically active compounds of *Butea monosperma*[34]

**Conclusion:**

Palash is a notable species with diverse importance, spanning from its ecological functions in biodiversity preservation to its traditional medicinal applications and cultural significance. It is essential to persist in research, conservation endeavors, and adopting sustainable management strategies to protect this invaluable natural asset and maximize its benefits for both humanity and the ecosystem.

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