INTRODUCTION

Butea monosperma is a species of Butea native to tropical and sub-tropical parts of the Indian Subcontinent and Southeast Asia, ranging across India, Bangladesh, Nepal, Sri Lanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia, and western Indonesia.\(^1\) Common names include **flame-of-the-forest** and **bastard teak**.\(^1\)

It is a medium-sized dry season-deciduous tree, growing to 15 m (49 ft) tall. It is a slow growing tree, young trees have a growth rate of a few feet per year. The leaves are pinnate, with an 8–16 cm (3.1–6.3 in) petiole and three leaflets, each leaflet 10–20 cm (3.9–7.9 in) long. The flowers are 2.5 cm (0.98 in) long, bright orange-red, and produced in racemes up to 15 cm (5.9 in) long. The fruit is a pod 15 20 cm (5.9–7.9 in) long and 4–5 cm (1.6–2.0 in) broad.\(^2-4\)

*Figure showing the Plant & the Flowering Plant of Butea monosperma*

In West Bengal, it is associated with spring, especially through the poems and songs of Nobel Laureate Rabindranath Tagore, who likened its bright orange flame-like flower to fire. In Santiniketan, where Tagore lived, this flower has become an indispensable part of the
celebration of spring. The plant has lent its name to the town of Palashi, famous for the historic Battle of Plassey fought there.\[^{[2-4]}\]

In the state of Jharkhand Palash is associated with the folk tradition. Many folk literary expressions describe palash as the forest fire. The beauty of dry deciduous forests of Jharkhand reach their height when most trees have fallen their leaves and Palash is in its full bloom. Palash is also the State Flower of Jharkhand.

It is said that the tree is a form of Agni, God of Fire. It was a punishment given to Him by Goddess Parvati for disturbing Her and Lord Shiva's privacy. In Telangana, these flowers are specially used in the worship of Lord Shiva on occasion of Shivratri. In Telugu, this tree is called Modugu chettu.\[^{[5,6]}\]

In Kerala, this is called 'plasu' and 'chamata'. Chamata is the vernacular version of Sanskrit word 'Samidha', small piece of wood that is used for 'agnihotra' or fire ritual. In most of the old namboodiri (Kerala Brahmin) houses, one can find this tree because this is widely used for their fire ritual.\[^{[5-6]}\]

Historically, dhak forests covered much of the doab area between the Ganges and Yamuna, but these were cleared for agriculture in the early 19th century as the English East India Company increased tax demands on the peasants.\[^{[3,5,6]}\]

**TAXONOMY OF BUTEA MONOSPERMA**\[^{[1,7-10]}\]

Kingdom: Plantae

Unranked: Angiosperms

Unranked: Eudicots

Unranked: Rosids

Order: Fabales

Family: Fabaceae

Genus: *Butea*

Species: *monosperma*

Sc. Name: *Butea monosperma*

**DISTRIBUTION OF PALASH (BUTEA MONOSPERMA)**

Palash or Dhak is found throughout India up to 1300-1400 m except in very arid parts. It is also found in Sri Lanka, India, Myanmar and other countries of Indian subcontinent.\[^{[2-4,11-13]}\]
TREE DESCRIPTION
A moderate sized, deciduous tree; bark fibrous, bluish grey or light brown outside; Leaves compound, with three leaflets, rachis 12-22.5 cm long, leaflets hard, rigidly coriaceous, glabrescent above and silky tomentose beneath; Flowers terminal, red in colour, appear on leafless tree giving an appearance of fire flame; Calyx dark brown, hairy outside and fleshy, grey-silky inside; Petals are bright orange-red; stamens, 2-adelphous;ovary shortly stalked; Pod 10-15 cm, bearing single seed at the end of the pod. [12,14-16]

Flowering: February-April; Fruiting: May-July.
Parts used: Seeds, gum, leaves, flower and bark.
The gum obtained from tree known as Gum Kino.

This oil has various medicinal properties. The gum obtained from the tree is rich in gallic acid and tannic acid and is referred to as Bengal kino gum or simply Butea gum. The leaves of the Butea monosperma are used as ingredients of tonics and aphrodisiacs and are also helpful in arresting bleeding or secretion.[14,17-18]

IN SCIENCE
Palash root bark contains beta-sitosterol, leucoanthocyanidin, amyrin, betulinic acid, stigma sterol and en active principal palasonin. Gum and bark contain tetramers of leucocyanidin. Palash flowers contain seven flavonoid glucosides, butrin, isobutrin, three glucosides (coreopsin, isocoreopsin and sulphurein), monospermoside and isomonospermoside. Palash leaves contain glucosides. Seeds contain proteolytic and lypolytic enzymes, Palasonin, monospermoside and somonospermoside. Palasonin from seeds has anthelmintic activity. Seeds administered as crude powder at doses of 1, 2 and 3 g/kg to sheep naturally infected with mixed species of gastrointestinal nematodes exhibited a dose and a time dependent
anthelmintic effect. The seeds are effective against *Ascaridia galli, Ascaris lumbricoides, earthworms, Toxocara canis, Oxyurids, Dipylidium caninum* and *Taenia.*[2-4,19-21]

**MEDICINAL USES OF PALASH/DHAK**

Various part of Palash tree are used in traditional medicine system, Ayurveda, Siddha and Unani, for treatment of variety of diseases. The seeds of tree have purgative, diuretic/stimulate production of urine and anthelmintic/ anti-parasitic properties. The seeds powder is used in case of intestinal parasites. The seeds when ground with lemon juice have powerful rubefacient (causing dilation of the capillaries and an increase in blood circulation) action and are used for treating Dhobi’s itch. Flowers and leaves are diuretic, aphrodisiac, astringent and increase flow of blood in pelvic region. In diarrhoea flower infusion is given.[22-24,26]

Palash tree bark yields a gum which is known as Bengal Kino. It has astringent action and is useful in case of haemorrhage. Many Ayurvedic medicines such as Krimikuthar rasa, Mahanarayana taila, Janma ghutti, Palasabeejadi Churna contain Palash as an ingredient.[2-4,27]

![Figure showing the Bark of Butea monosperma](image)

**CAUTION, SIDE-EFFECTS OF PALASH (BUTEA MONOSPERMA)**

Like every other medicine, Herbs also have some side-effects.

1. Butin from Palash seeds have anti-conceptive and anti-implantation activity.
2. The seeds exhibited anti-implantation, pregnancy terminating and reduction in the number of implantation sites in dose dependent manner.
3. Butin has weak estrogenic activity.
4. Palash seeds are used traditionally as contraceptive.[1-4,28]
The seeds must be used as medicine for short duration and in recommended dosage. When seeds are given for longer duration to rats, dogs and rabbits, nephrotoxicity, anaemia, gross dilation of stomach, gastric inflammation, liver enlargement and spleen enlargement (with congestion) occurred.

The herb *Butea monosperma* belongs to the plant family Fabaceae and the order Fabales. This herb is commonly known as Palas in Hindi. It is also called “the flame of the forest” due to the bright orange and scarlet colors of its flowers. It follows the trade name “Butea” which has been taken from its scientific name *Butea monosperma*.¹³

**HISTORICAL DETAILS**

The tree *Butea monosperma* was discovered in India and its therapeutic properties were first discovered here as well. Its parts have been used ever since for various medicinal purposes.

**AREAS OF CULTIVATION**

This tree is native to India and can be found growing all over the country but it is most easily spotted in the mixed and/ or dry deciduous forests located in Central India and Western India.²⁹-³⁰

**PARTS USED**

The parts of the herb *Butea monosperma* that are used for medicinal purposes are its flowers, its leaves the gum obtained from the plant, its seeds and the oil that can be extracted from the flowers as well as the seeds. The flowers of the tree are rich in glucosides, butin, neteroside and butrin whereas the seeds are a rich source of moodooga oil or kino- tree oil which is a fixed oil and is yellow colour. This oil has various medicinal properties. The gum obtained from the tree is rich in gallic acid and tannic acid and is referred to as Bengal kino gum or simply *Butea* gum. The leaves of the *Butea monosperma* are used as ingredients of tonics and aphrodisiacs and are also helpful in arresting bleeding or secretion.²⁹-³⁰

**CHARACTERISTICS OF BUTEA MONOSPERMA**

The *Butea monosperma* is famously known as the “flame of the forest” and the reason behind the tree getting accorded this name is that it bears very bright flowers which are either orange or scarlet in colour. When the tree is in full bloom, the flowers grow in a number of clusters and the appearance of the tree is then such that it looks as if it has been set aflame, hence, the name. The tree Palas is of medium height and has compound leaves. The leaves of the tree
fall off in the winter season and the flowers then bloom in the months of February and March. The flowers grow in huge clusters and on leaf-less branches. The fruits that the plant bears are in the shape of flat pods and each fruit contains a single seed within itself.\[29-30\]

**MEDICINAL PROPERTIES USEFUL AGAINST DISEASES**

The herb *Butea monosperma* has found many uses as a medicinal herb. It can be used internally or as a preparation that can be applied externally. \[3,7\]

Its uses are given below in detail:

**Internal Uses**

- **Diarrhea**–
  The gum of the tree can be used to relieve Diarrhea when taken in three doses regularly. It is however not suitable for women and children to consume this gum.

- **Dysentery**–
  The gum of the plant is also useful in relieving dysentery.

- **Intestinal Worms**–
  The seeds of Butea can be ground into a powdered form and this powder can then be consumed to kill worms in the stomach and the intestines.

- **Diabetes**–
  The leaves of the tree help reduce blood sugar and relieve Diabetes.

- **Sore Throat**–
  The leaves of the tree can be boiled in water and this can be used as a mouthwash to relieve sore throat.

**EXTERNAL USES**

- **Skin Disorders**–
  For relieving eczema, itching and/ or other skin disorders, the seeds should be ground to a paste and the paste should then be applied to the affected area regularly.

- **Leucorrhoea**–
  The leaves are also beneficial in the management of Leucorrhoea. A decoction prepared from them should be used to wash the genital parts regularly to relieve the disease.

- **Retention of Urine**–
  The leaves of the plant should be made into a decoction to wash the pubic region regularly with so as to increase the retention of urine.
USE OF BUTEA MONOSPERMA IN AROMATHERAPY
The herb *Butea monosperma* has not found any medicinal use in Aromatherapy as of yet.

PRECAUTIONS AND SAFETY MEASURES WHILE USING BUTEA MONOSPERMA
The *Butea monosperma* is a very safe herb to use. However, this should not be done without taking proper medical advice from a doctor. In fact, medical advice should be sought before the usage of any herb or drug.

PRODUCTS OF PLANET AYURVEDA THAT MAKE USE OF BUTEA MONOSPERMA
As of now there are no Planet Ayurveda products which contain *Butea monosperma*. But the below mentioned other products of Planet Ayurveda are useful in some conditions for which *Butea monosperma* is used.[31-32]

Plant kingdom represents a rich source of organic compounds, many of which have been in use as agents against several infectious and non-infectious diseases, by the modern medicinal system.

The World Health Organization estimated that about an 80% population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs. Particularly in rural India, uses of raw plant products as well as some concoction of plant products in Ayurvedic medicines are sought after to a great proportion, because of cheap availability, and in urban areas too those are increasingly popular for cultural nuances that exist. Further, a large number of phyto-drugs are popular and are preferred to over synthetic ones—*a priori*, for healthier or rather harmless effects; almost all the viral infections are always addressed with plant products, as it is known. In ethno-botanical literature of India, several hundreds of plants are known to have the potential to treat many diseases and one of those popular ones is *Butea monosperma* Lam. (*B. monosperma*, family Fabaceae. *B. monosperma* is traditionally used for the treatment of inflammatory diseases; it is hepatoprotective, antidiabetic, antihelmintic, it possess antitumor, antiulcer activities and wound healing, leaves possess antimicrobial property, and roots have antispermatic activity.[32]
Infections with both Gram-positive (GP) and Gram-negative (GN) bacteria have clinically become intractable, slowly, due to the emergence of multidrug resistant (MDR) strains. Among GP pathogens, strains of *Staphylococcus aureus* (*S. aureus*), methicillin resistant *S. aureus* (MRSA) and vancomycin resistant *S. aureus* (VRSA), strains of *Enterococcus* sp. are noteworthy. Moreover, GN bacteria, *Acinetobacter* sp., *Klebsiella pneumoniae* (*K. pneumoniae*), *Citrobacter freundii* (*C. freundii*), *Escherichia coli* (*E. coli*) and *Pseudomonas aeruginosa* (*P. aeruginosa*) are commonly found as pathogens of urinary tract; while *E. coli*, *K. pneumoniae*, are pathogens of gastrointestinal tract. Presently, these pathogens are too MDR, recorded in several reports.

**PREPARATION OF PLANT EXTRACT:**

After seeing the different activities of *Butea monosperma*, we thought that few basic and biotechnological applications should start. For that purpose we were going through the extraction process of the plant. First of all we collected all the parts of the plant and shaded dried and did all for further as mentioned below:

The air-dried powdered leaf material (in 40 g lots) of *B. monosperma* was extracted with 400 mL volumes of solvents, petroleum ether, acetone, methanol, ethanol and distilled water, separately at 4 °C, in succession. Solvent residues from combined extracts were evaporated by a vacuum rotary evaporator. For hot extraction, in a soxhlet apparatus, a lot of 40 g of powder-mass was placed in the extractor and a volume of 400 mL of a solvent was used during 24 h of soxhletion, till colourless extracts precipitated in the extractor. After filtration, each extract was concentrated by the rotary evaporator. The resultant sticky-mass was dried in a desiccator; the solid mass was stored in a suitable volume of 10% dimethyl sulfoxide (DMSO) with a drop of Tween-80. Cold and hot petroleum ether extracts of *B. monosperma* were light yellow to yellowish brown in colour. After concentration, the solid physical appearance was seen and the yield amounts were 3.7% in the cold- and 4.2% in the hot-extract. The solid extract was dissolved in a required volume of 10% DMSO and a drop of Tween-80 for a final concentration of 30 mg/mL. Both cold and hot extracts of acetone were brown in colour, it was sticky in appearance after concentration and the yield amounts were 3.12% in the cold and 4.27% in the hot extract. Ethanol extracts were reddish brown in colour and sticky after concentration. The yield amounts were 6.24% in the cold and 7.90% in the hot extract. Methanol extracts were dark-brown to black in colour and solid, sticky in concentration; after the desiccation amounts were 7.20% in the cold and 8.20% in the hot extract.
extracts. Aqueous extracts were black in colour and sticky after the concentration. After desiccation, the amounts were 10.78% in cold and 10.82% in hot extracts. The stock concentration of each extract was maintained at 30 mg/mL, for further use.

QUALITATIVE TEST FOR PHYTOCHEMICALS:
Phytochemical screening was carried out to assess the qualitative chemical composition of crude extracts using commonly employed precipitation and colouration procedure to identify the major natural chemical groups, as described earlier (Dubey D, et al., 2012). Alkaloids, carbohydrates, flavonoids, glycosides, protein, saponin, starch, sterols and tannins were assessed.

PHYTOCHEMICAL ANALYSES:
From phytochemical analyses, it was ascertained that saponins and tannin, but not sterol and protein were present in leaf-extracts, obtained with petroleum ether, acetone, ethanol, methanol and water. Alkaloids, carbohydrates, glycosides were present in extracts obtained with petroleum ether, ethanol and water. Starch only was found in extracts obtained with acetone and water; in water extract the maximum number of phyto-constituents and the acetone extract had the least number were noted, and extracts with the rest other solvents had medium levels of phyto-constituents.

ANTIBIOTIC SENSITIVITY PATTERN:
Few Earlier researchers worked on the Antibiotic profile of Palash and in each cases bacterial strain was determined using specified antibiotic discs. It was recorded that antibiotics (μg/disc), gentamicin 30 was resistant to seven bacteria and sensitive to one bacteria; norfloxacin 300 was resistant to three and sensitive to five strains; nitrofurantoin 300 was resistant to one and sensitive to seven strains; amikacin 30 was resistant to one and sensitive to seven strains; amikacin 30 was resistant to one and sensitive to seven bacteria; cefotaxime 30 was resistant to seven; imipenem 10 was resistant to seven and sensitive to one; piperacillin/tazobactam 100/10 was resistant to seven and sensitive to one bacterium; gatifloxacin 30 was resistant to four and sensitive to four isolates; ofloxacin 5 was resistant to four and sensitive to four strains; netilmicin 30 was resistant to five and sensitive to three isolates; amoxyclav 30 was recorded as resistant to five and sensitive to three bacteria.
ANTIBACTERIAL ACTIVITIES

Five pairs of cold and hot leaf-extracts extracted with petroleum ether, acetone, ethanol, methanol and water (non-polar to polar solvents) were screened for anti-bacterial activity against cited GP bacteria and five GN bacteria. Hot water extracts had the highest antibacterial activity against Enterococcus sp. Leaf-extracts with hot water and ethanol have shown significant antibacterial activity against all bacteria. The maximum size of zone of inhibition had been recorded due to the hot water extract, as 21 mm against Enterococcus, which was 18 mm in the case of ciprofloxacin 30 μg/disc. Detailed information of antibacterial activities of extracts and inhibition zone sizes were recorded.\textsuperscript{[29-30]}

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