

## PLANT REVIEW: *Butea monosperma*

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### ABSTRACT

*Butea monosperma* (Lam.) Kuntze (Syn. *Butea frondosa*; Family Fabaceae), This is a moderate sized deciduous tree which is widely distributed throughout India, Burma and Ceylon, popularly known as 'dhak' or 'palas', commonly known as 'Flame of forest'. The family Fabaceae comprises of 630 genera and 18,000 species. The crude extracts of various parts and pure isolates of *Butea monosperma* was reported to possess antibacterial, antifungal, hypoglycemic, anti-inflammatory activities. *Butea monosperma* have been found to possess tonic, astringent, aphrodisiac and diuretics properties. The widespread uses of *Butea monosperma* in traditional systems of medicine have resulted in their extensive chemical analysis for their bio-active principles. This article briefly reviews the botany, chemistry and pharmacology of *Butea monosperma* (Lam) Kuntze.

**Keywords:** *Butea monosperma*, fabaceae, dhak, palas.

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### INTRODUCTION

It is evident that without nature human being life is impossible. There are three basic necessity of humans is food, clothes and shelter and now the fourth one is good health, which provided by plant kingdom. Nature stands a golden mark and provided the storehouse of remedies to cure all ailments of mankind. Plant kingdom represents a rich house of organic compounds, many of which have been used for medicinal purposes and could serve as lead for the development of novel agents having good efficacy in various pathological disorders in the coming years. Herbs have always been the principal form of medicine in India and presently they are becoming popular throughout the world, as people strive to stay healthy in the face of chronic stress and pollution, and to treat illness with medicines that work in count with the body's own defence. There is a widespread belief that green medicines are healthier and more harmless or safer than synthetic ones.

In traditional medicine, there are many natural crude drugs that have the potential to treat many disease and disorders one of them is *Butea monosperma* (Lam.) Taub (Syn. *Butea frondosa*; Family Fabaceae) popularly known as 'dhak' or 'palas', commonly known as 'Flame of forest', palash, mutthuga, bijasneha, khakara, chichara, Bastard teak, Bengal kino. (1)

They comprise one of the largest families of flowering plants, numbering 630 genera and 18,000 species. (2) This is a moderate sized deciduous tree which is widely distributed throughout India, Burma and Ceylon extending in the north west himalayas as far as Jhelum except in very acrid parts. (3)

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It is one of the most beautiful tree has been put to some useful purpose. *Butea monosperma* is extensively used in Ayurveda, Unani and Homeopathic medicine and has become a cynosure of modern medicine. The plants of this genus are well known for their colouring matters. Commonly *Butea monosperma* is used as tonic, astringent, aphrodisiac and diuretics. (4)

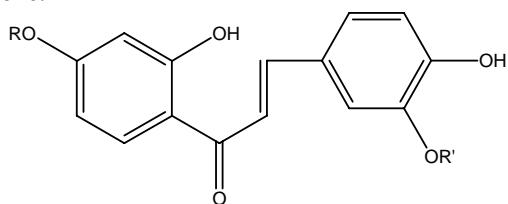
Roots are useful in filariasis, night blindness, helminthiasis, piles, ulcer and tumours. (5) It is reported to possess antifertility, aphrodisiac and analgesic activities. (2)

Flowers are useful in diarrhoea, astringent, diuretic, depurative and tonic (33). The stem bark is useful in indigenous medicine for the treatment of dyspepsia, diarrhoea, dysentery, ulcer, sore throat and snake bite. Besides medicinal uses it is also having the economic use such as leaves are used for making platters, cups, bowls and beedi wrappers (2) Bark fibres are used for making cordage. (1) Wood is used for well curbs and water scoop. It is a cheap board wood. Wood pulp is suitable for newsprint manufacturing. (6) *Butea* is also a host to the Lac insect, which produces natural lacquer. (61)

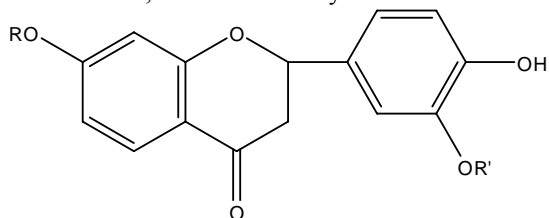
*Butea superba* is a native herb in the family of Papilionaceae. The Plant twinning woody long-life herbal plant exists only in Thailand. This species can be found in the same habitat as *Pueraria Mirifica* in the mountainous area. The long shape tuberous were annually enlarged and accumulated at least 15 chemicals in the group of direct chain organic acid especially flavonoids and flavonoid glycosides with c-AMP Phosphodiesterase potent inhibitor directly at the corpus cavernosum of the penis and resulted in enhancing blood flow to that area. In addition, it supports normal sexual function, erectile capacity, enhance sensitivity and better

performance. The preparation of *Butea superba* tubers has been used as an alternative herbal treatment for erectile dysfunction in males. (7) The tubers of *Butea superba* have been found to contain estrogenic substances similar to follicle hormones. (8) Roots of *Butea superba* show rejuvenating activity (9). The root barks of *Butea superba* shows 65% inhibitory activity on acetylcholinesterase.(10)

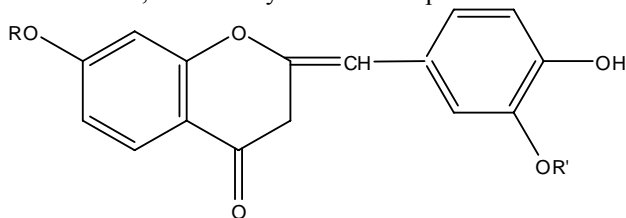
*Butea parviflora* also known as climbing Butea and palashabheda, is a large woody licine with large trifoliate leaves, white or cream coloured flowers and single seeded fruit found throughout in india. Roots contain rotenone.



R = H, R' = Glucosyl - Monospermoside, R=R'=H - Butein, R=R' = Glucosyl - Isobutrin



R=R' = H - Butein, R = R'= Glucosyl - Butrin, R=H,R'=Glucosyl - Isomonospermoside.



R= R' = Glucosyl

#### BOTANICAL DESCRIPTION

An erect tree 12-15 m high with crooked trunk and irregular branches, bark rough, ash coloured, young parts downy. Leaves 3-foliate, petioles 10-15 cm long, stipules linear lanceolate. Leaflets coriaceous (the terminal 10-20 cm long, broadly ovate from a cuneate base, the lateral smaller, 10-15 by 7.5 – 10 cm, obliquely rounded at the base, equilateral, the lower side the larger), all obtuse, glabrous above when old, finely silky and conspicuously reticulately veined beneath; petioles 6 mm long, stout-stipels subulate, deciduous. Flowers large, in a rigid racemes 15 cm long, 3 flowers together form the tumid nodes of the dark olive-green velvety rhachis; pedicels about twice as long as the calyx, densely brown-velvety; bracts and bracteoles small, deciduous. Calyx 13 mm long, dark olive-green, densely velvety outside, clothed with silky hairs within: teeth short, the 2 upper connate, the 3 lower equal, deltoid. Corolla 3.8-5cm long, clothed outside with silky, silvery

hairs, orange or salmon coloured: standard 2.5 cm broad: keel semicircular, beaked, veined. Pods stalked 12.5-20 by 2.5-5 cm, thickened at the sutures, reticulately veined argenteo-canescens: stalked 2 cm long (1, 2).

#### CHEMICAL CONSTITUENTS

Flower - Triterpene (35),several flavonoids butein, butin, isobutrin, coreopsin, isocoreopsin (butin 7-glucoside), sulphurein, monospermoside(butein 3-e-D-glucoside) and isomonospermoside, chalcones,aurones, isobutyne, , palasitrin, 3',4',7- trihydroxyflavone (11). Myricyl alcohol, stearic, palmitic, arachidic and lignoceric acids (13 ) glucose, fructose, histidine, aspartic acid, alanine and phenylalanine (14 )

Gum -Tannins, mucilaginous material, pyrocatechin (1). Seed - Oil (yellow, tasteless), proteolytic and lypolytic enzymes, plant proteinase and polypeptidase. (Similar to yeast tripsin) (2). A nitrogenous acidic compound, along with palasonin is present in seeds . It also contains monospermoside (butein3-e-D-glucoside) and somonospermoside(11 ). Allophanic acid, several flavonoids (5, 6, 7, 4'-tetrahydroxy-8-methoxyisoflavone 6-O-rhamnopyranoside. (15) Butin (37) $\alpha$ -Amyrin,  $\beta$ -sitosterol,  $\beta$ -sitosterol- $\beta$ -D-glucoside, sucrose (16 ), Fatty acids such as myristic, palmitic, stearic, arachidic, behenic, lignoceric, oleic, linoleic and linolenic (16) Monospermin(18). And an acid imide.(19) 15-Hydroxypentacosanoic acid nheneicosanoic acid  $\delta$ -lactone (21). 10, 16-dihydroxyhexadecanoic acid (22)Phosphatidylcholine, phosphatidylethanolamine and phosphatidylinositol (23 )

Root- The root of *Butea monosperma* contains glucose, glycine, a glycoside (aglycon) and an aromatic hydroxy compound (28)

Stem- 3-Z-hydroxyeuph-25-ene and 2,14-dihydroxy-11,12-dimethyl-8-oxo-octadec-11-enylcyclohexane (58) Stigmasterol-e-D-glucopyranoside and nonacosanoic acid (35) Flavonoid 8-C-prenylquercetin 7,4'-di-O-methyl-3-O- $\alpha$ -L-rhamnopyranosyl(1-4)- $\alpha$ -L-rhamnopyranoside.(25) 3-hydroxy-9~methoxypterocarpan [(-)-medicarpin]. Lupenone, lupeol and sitosterol. Two iso flavones 5-methoxygenistein and prunetin (26). In addition to stigmasterol-3- $\alpha$ -L-arabinopyranoside, four compounds isolated from the stem of *Butea monosperma* have been characterized as 3-methoxy-8,9-methylenedioxypterocarp-6-ene, 21-methylene-22-hydroxy-24-oxooctacosanoic acid Me ester, 4-pentacosanylphenol and pentacosanyl- $\beta$ -D-glucopyranoside (27).

Bark - Kino-tannic acid, Gallic acid, pyrocatechin (4). Also contains palasitrin, and major glycosides as butrin, alanind, allophanic acid, butolic acid, cyanidin, histidine, lupenone, lupeol, (-)-medicarpin, miroestrol, palasimide and shellolic acid (4, 53, 34, 16, 17, 18, 19, 20). Two compounds, 3, 9-dimethoxypterocarpan, and triterpenoid ester, 3 $\alpha$ -hydroxyeuph-25-enyl heptacosanoate.(27)

Leaves - Glucoside, Kino-oil containing oleic and linoleic acid, palmitic and lignoceric acid. (13)

Resin - Jalaric esters I, II and laccijalaric esters III, IV.; Z-amyrin, e-sitosterone and its glucoside ,sucrose, lactone-nheneicosanoic acid- $\delta$ -lactone (51,52)

Sap - Chalcones, butein , butin, colourless isomeric flavanone and its glucosides, butrin (1).

#### Biological and Pharmacological Activities

##### *Antifungal activity, antimicrobial activity, antibacterial activity*

The stem bark of *Butea monosperma* displays antifungal activity, which is due to the presence of an active constituent (-)-medicarpin. (26) The seed oil of *Butea monosperma* shows significant bactericidal and fungicidal effect in in-vitro testing (18)

##### *Anti-inflammatory activity*

The leaves of *Butea monosperma* exhibit ocular anti-inflammatory activity in rabbits(5 ), The anti-inflammatory activity of methanolic extract of *Butea monosperma* evaluated by carrageenin induced paw edema and cotten pellet granuloma. In carrageenin induced paw edema at 600 and 800 mg/kg inhibition of paw edema, by 26 and 35% and in cotten pellet granuloma inhibition of granuloma tissue formation, by 22 and 28%. (36)

##### *Liver disorders*

An extract from the flowers of *Butea monosperma* is used in India for the treatment of liver disorders and two antihepatotoxic flavonoids, isobutrin and butrin have been isolated from the extract (29). The effect of pretreatment of methanolic *Butea monosperma* extract prior to TAA treatment at two doses and the results suggest that it may contribute to the chemo preventive effect. *Butea monosperma* showed a significant recovery in the level of glutathione and its metabolizing enzyme in the liver induced the detoxifying enzyme system, which is shown by the elevated levels of other QR, SOD, GPx, and xanthine oxidase, which are important phase II enzymes. (45)

##### *Anticonvulsive activity*

It shows anticonvulsive activity, due to the presence of a triterpene (42). The ethanolic extracts of leaves of *Albizia lebeck* and flowers of *Hibiscus rosa sinensis* and the petroleum ether extract of flowers of *Butea monosperma* exhibited anticonvulsant activity. The acetone soluble part of petroleum ether extract of *Butea monosperma* flowers showed anticonvulsant activity. The fractions protected animals from maximum electro shock, electrical kindling pentylenetetrazole and lithium-pilocarpine induced convulsion but failed to protect animals from strychnine-induced convulsions. The fractions raised brain contents of gamma-aminobutyric acid (GABA) and serotonin. (62)

##### *Antiesterogenic and antifertility activity*

Alcoholic extract of flowers of *Butea monosperma* has also been reported to exhibit antiestrogenic. (44). Hot alcoholic extract of *Butea monosperma* seeds have been reported for significant anti ovulatory and anti-implantation activities when given to rats and rabbits. The active constituent has been identified as butin (37). Butin also exhibits male contraceptive properties (32). Antifertility effect of seed extract of *Butea frondosa* has also been reported in mice. (17) The stem bark of *Butea monosperma*, led to the isolation and identification of three new compounds named butaspermmin A, butaspermmin B and butaspermmanol, along with 19 known compounds. (43)

##### *Hemagglutinating activity*

Seeds of *Butea monosperma* showing specificity towards human erythrocytes.(33). The lectins such as *Butea monosperma* agglutinin (BMA) isolated from the seeds of *Butea monosperma* are responsible for agglutinating property (64) this property was only shown by seeds not by flowers, leaves, roots and stems. Human blood group-A-specific agglutinins have been demonstrated in some of the N-acetyl galactosamine/galactose –binding lectins, such as the lectins. Hemagglutination test showed that N-acetyl galactosamine is the strongest inhibitor of agglutination, (40)

##### *Antidiabetic activity*

The single dose treatment of ethanolic extract of *Butea monosperma* flowers at the dose of 200mg/kg P.O. significantly improved glucose tolerance and cause reduction in blood glucose level in alloxan induced diabetic Rats. (39) .Oral administration of the ethanolic extract of the *Butea monosperma* seeds at the dose of 300mg/kg b.w., exhibited significant antidiabetic, hypolipaemic and antiperoxidative effects in non-insulin dependent diabetes mellitus rats. (41)

##### *Wound healing activity*

The topical administration of an alcoholic bark extract of *Butea monosperma* on cutaneous wound healing in rats. Full-thickness excision wounds were made on the back of rat .The granulation tissue formed on days 4, 8, 12 and 16 (post-wound) was used to estimate total collagen, hexosamine, protein, DNA and uronic acid. The extract increased cellular proliferation and collagen synthesis at the wound site, as evidenced by increase in DNA, total protein and total collagen content of granulation tissues. The extract treated wounds heal much faster than normal animals as indicated by improved rates of epithelialisation and wound contraction, tensile strength and histopathological examinations. *Butea monosperma* exhibited wound healing activities due to its antioxidant properties. (60)

##### *Diarrhoea*

*Butea monosperma* gum has also been found useful in cases of chronic diarrhoea. It is a powerful astringent and also decreases bilirubin level (65)The ethanolic extract of stem bark of *Butea monosperma* at 400 mg/kg and 800mg/kg inhibited castor oil induced diarrhoea due to inhibiting gastrointestinal motility and PGE<sub>2</sub> induced enteropooling. It is used as nonspecific anti diarrhoeal agent in folk medicine. (39).

##### *Giardiasis*

Giardiasis is a common gastrointestinal infection caused by a protozoal parasite, *Giardia lamblia*. Pippali rasayana (PR), an Ayurvedic herbal medicine, prepared from *Piper longum* (Pippali) and *Butea monosperma* (Palash) in which ash of stem, root, flower and leaves of *Butea monosperma* is used, has significant activity against Giardiasis It produced up to 98% recovery from the infection. The rasayana had no killing effect on the parasite in vitro. It induced significant activation of macrophages as evidenced by increased macrophage migration index (MMI) and phagocytic activity. With higher doses of PR recovery increased up to 98% at 900 mg/kg (63) Flowers of this plant are also effective in leprosy, leucorrhoea and gout (2)

##### *Anthelmintic activity*

The seeds of the plant are used in Ayurvedic system as an anthelmintic drug. (31) The crude powder of *Butea monosperma* seeds (CP) showed a dose-dependent (1–3 g/kg) and a time-dependent anthelmintic activity in sheep. The anthelmintic activity of different species of *Butea* has been reported against *Ascaridia galli*, *Ascaris lumbricoides*, earthworms, *Toxocara canis*, *Oxyurids*, *Dipylidium caninum* and *Taenia*. (48)

#### Free radical scavenging

Free radical scavenging activity of various extracts of flowers evaluated by using different in-vitro models like reducing power assay, scavenging of 2,2 diphenyl-1-picrylhydrazyl (DPPH) radical, nitric oxide radical, superoxide anion radical, hydroxyl radical and inhibition of erythrocytes hemolysis using 2,2' azo-bis (amidinopropane) dihydrochloride (AAPH). Methanolic extract along with its ethyl acetate and butanol fractions showed potent free radical scavenging activity. The observed activity could be due to higher phenolic contents in the extracts (8).

Thyroid inhibitory, antiperoxidative and hypoglycemic effects

Stigmasterol, isolated from the bark of *Butea monosperma* was evaluated for thyroid hormone and glucose regulatory efficacy in mice. The administration at 2.6 mg/kg/d for 20 days reduced serum triiodothyronine ( $T_3$ ), thyroxine ( $T_4$ ) and glucose concentrations as well as the activity of hepatic glucose-6-phosphatase (G-6-Pase) with a increase in insulin. Showed its thyroid inhibiting and hypoglycemic properties. Antioxidative potential due to decrease in the hepatic lipid peroxidation (LPO) and an increase in the activities of catalase (CAT), superoxide dismutase (SOD) and glutathione (GSH). The highest concentration tested (5.2 mg/kg) evoked pro-oxidative activity. (59)

#### NUTRITIVE EVALUATION

The nutritive value of leaf extract of *Butea monosperma* is OM- 889.2, CP- 150.2, NDF- 506.1, ADF- 356.0, Cellulose- 151.2, Hemicellulose- 150.2, Lignin- 130.7, Total phenolics- 6.5, and Condensed Tannins-20.8.(34)

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