


REVIEW ARTICLE

A COMPREHENSIVE REVIEW: BUTEA MONOSPERMA (LAM.) KUNTZE
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Abstract

Butea monosperma (Lam.) Kuntze, frequently known as Flame of forest, belongs to the family Fabaceae. In traditional medicine, there are many natural crude drugs that have the prospective to take care of many disease and disorders one of them is *Butea monosperma* (Lam.). It is one of the most attractive tree has been put to some useful purpose in Ayurveda, Unani and Homeopathic medicine and has become a cynosure of modern medicine. The plant is highly used by the rural and tribal community in curing diverse disorders. Commonly it is used as tonic, astringent, aphrodisiac and diuretics. Thus it holds a significant place because of its medicinal and other miscellaneous uses of economic values. This Review particularly deals with the Phytoconstituents, Ayurvedic importance along with the pharmacological aspects of *Butea monosperma* (Lam.) Kuntze.

Keywords: *Butea monosperma*, Ayurveda, astringent, diuretics, Phytoconstituents.

Introduction

Butea monosperma (Palash) which belongs to the family Fabaceae grows wildly in India, Burma and Sri Lanka. It is capable of growing in water logged situations, black cotton soils, saline, alkaline, swampy badly drained soils and on barren lands except in arid regions. *Butea monosperma* is most popularly known as 'flame of the forest' because of its vibrant red colour flowers (Patil et al., 2006). The tree loses its leaves as the flowers develop, in the month of January until March. It is well known as tesu, palash, mutthuga, bijasneha, dhak, khakara, chichra, bastard teak, Bengal kino by local being and tribes (Kirtikar et al., 1935).

Butea monosperma is an erect tree rising up to the height of 12-15 m with uneven branching. The bark is rough, ash coloured. The seeds are flat, reniform, and curved. Flowers in rigid racemes of 15 cm long, densely brown velvety on bare branches.

The Leaves of plant are tri-foliolate, petiolate with stipules linear lanceolate, all obtuse, glabrous above when old, finely silky and conspicuously reticulate veined beneath (Boutelje, 1980).

It is a blessed tree, called as a treasurer of the gods. Sacred utensils are made from its wood. The flowers are used as in place of blood in sacrifice rituals to goddess kali. *Butea* is frequently used in Yagnas performed by priests in India. Its flowers are dried and colors made from it are used to celebrate Holi festival. It is also used to worship during Sivaratri and is believed that the tree is a form of Agnidev, God of Fire (Burlia et al., 2007).

Butea is in addition medicinally vital tree as its diverse parts are used to treat various clinical ailments. It is conventionally used by the rural and tribal people in curing various disorders. The leaves

are diuretic, depurate, astringent and aphrodisiac. Flowers are used against numerous ailments like enlargement of spleen, eye disease, epilepsy, leprosy, chronic fever antifungal activity, anti-inflammatory activity, leucorrhoea, liver disorders, antifertility activity and gout etc (Ambasta, 1994). The seed exhibit excellent anthelmintic property and acts as a rubefacient when pounded with lemon juice and applied to the skin (Bhalla et al., 1999). The plant parts are used in the form of extract, juice, infusion, powder and gum. Its gum is known as Bengal Kino and is considered precious by druggists because of its astringent behavior and by leather workers because of its tannin. The use of its gum as external astringent application is mentioned by 'Chakradatta' (Nadkarni, 2002).

The palash flowers yields a reddish orange dye which is used as an insecticide and as coloring agent. The dye is also used as a dyeing fabric. Its flowers are tonic and nutritive. Its roots are used to care for night blindness. The tree is a good host for the lac insect and therefore, it is useful in making of natural lac (Anonymous, 1997; Chopra et al. 1969). It holds a key place because of its medicinal and other miscellaneous uses of economic values.

Phytoconstituents

Flower: Monospermoside (butein 3-e-d-glucoside) and isomonospermoside, butin, chalkiness', aureoles, flavonoids (palasitrin, prunetin) and steroids, triterpene, butein, isobutrin, coreopsin, isocoreopsin (butin 7-glucoside), sulphurein (Gupta et al., 1970; Lavhale et al., 2007) .

Leaves: Glucoside, Kino-oil containing oleic and linoleic acid, palmitic and lignoceric acid (Nadkarni's, 2002; Mishra et al., 2000).

Bark: Kino-tannic acid, Gallic acid, pyrocatechin. The plant also contains palasitrin, and major glycosides as Butrin, butolic acid, cyanidin, allophanic acid, histidine, lupenone, lupeol, (-)-medicarpin, miroestrol, palasimide and shellolic acid. Two compounds, 3, 9-dimethoxypterocarpan, and triterpenoid ester, 3 - hydroxyeuph-25-enyl heptacosanoate (Nadkarni's, 2002; Mishra et al., 2000; Schoeller et al. 1938).

Root- The root of *Butea monosperma* contains glucose, glycine, a glycoside (aglycon) and an aromatic hydroxy compound (Bodakhe et al., 2004).

Stem: Stigma sterol-e-D-glucopyranoside and nonacosanoic acid, 3-Z-hydroxyeuph-25-ene and 2, 14-dihydroxy- 11, 12- dimethyl-8-oxo-octadec-11 enylcyclohexane (Gunakkunru et al., 2005; Agarwal et al. 1994).

Gum: Tannins, mucilaginous material, pyrocatechin (Guha et al., 1990; Shukla et al., 2000).

Seed: A nitrogenous acidic compound, along with palasonin is present in seeds. It also contains monospermoside (butein 3-e-d-glucoside) and so monospermoside, oil (yellow, tasteless), proteolytic and lypolytic enzymes, plant proteinase and polypeptidase (Singh et al., 1974; Jawaharlal et al., 1978).

Resin: From seed coat allophanic acid, Z- Amyrin, e-sitosterone its glucoside and sucrose; lactone-nheneicosanoic acid-delta-lactone, jalaric esters i, ii and laccijalaric esters iii, IV (Gawale et al., 2001).

Sap: Colourless isomeric flavanone and its glucosides, butrin, chalcones, butein, butin (Wagner et al., 1986).

Ethnobotanical uses

Flowers of *B. monosperma* is conventionally used as diuretic, antileprotic, antiinflammatory, anticonvulsant, antioxidant, antigout, antiulcer, antistress, memory and behavior stimulant, astringent and antihepatotoxic (Burlia et al., 2007). Flower is in addition used to treat enlarged spleen, burning sensation menstrual disturbances and eye diseases. Flowers are astringent to bowel, in treat "Kapha", thirst, gout, skin diseases, leprosy, strangury, sensation; flower juice is helpful in eye diseases. Flower is bitter, aphrodisiac, expectorant and tonic, emmenagogue, diuretic and good in biliousness, inflammation and gonorrhoea (Ambasta, 1994). The dye is useful in enlargement of spleen. Flowers are depurative, as a poultice they are used to disperse swelling and to encourage menstrual flow. They are given to pregnant women in case of diarrhoea. It is also useful to avoid pus from urinogenital tracts of males. Flowers are crushed in milk and sugar is added, 3-4 spoons if drunk per day for a month helps to decrease body heat and chronic fever. Flowers are soaked in water overnight and a cup of this infusion is drunk every morning against leucorrhoea till cure (Bhargava, 1986).

Table 1: Taxonomic Position of *Butea monosperma* (Lam.) Kuntze

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Class	Magnolipsida
Subclass	Rosidae
Order	Fabales
Family	Fabaceae
Genus	<i>Butea</i>
Species	<i>monosperma</i>

Table 2. Vernacular Names of *Butea monosperma* (Lam.) Kuntze

Sanskrit	Bijasneha, Kamalāsana, Karaka, Kimsuka, RaktapS4uspaka, Palasha
Hindi	Dhak, Palas, Tesu, Chichra, Kakria, Kankeri,
English	Bastard teak ,Bengal kino tree ,Flame of Forest
Bengali	Palas, Nim
Telugu	Palasamu, Moduga, Hettu, Tellamoduga, Kimsukamu, Togarumo-duga
Gujrati	Khakra, Khadka, Khakhado, Kesoodo, Khakhroo, Plassoo
Punjab	Dhak, Palas, Tesu, Chichra
Malayalam	Chamatha, Kimshukam, Bramhavriksham
Marathi	Palas, Nim
Urdu	Dhak, Palaspada
Oriya	Polas, Porasur

Leaf of *B. monosperma* is traditionally used as carminative, astringent, antiinflammatory, antimicrobial, anthelmintic, antitumor, diuretic, antidiabetic, appetizer and aphrodisiac. These are also used to care for stomach disorders, diabetic sore throat, irregular bleeding during menstruation, flatulent colic, cough and cold. Leaves are excellent for the disease of the eye. Leaf is an appetizer, astringent, carminative, anthelmintic, aphrodisiac, tonic, lessens inflammation and lumbago, cures boils and piles. Petiole is chewed and the juice is sucked to cure cough, cold and stomach disorders. Leaf powder about 2 spoons per day for a month is drunk mixed with a cup of water to cure diabetes. Leaf extract is used as gargle in case of sore throat. Leaf extract about 3-4 spoons is drunk at night for 2-3 months. It checks unbalanced bleeding during menstruation (Mengi et al., 1995).

Stem bark is traditionally used as aphrodisiac, antidysentery, antiulcer, antitumor, antimicrobial, antifungal, antipyretic, blood purifier and anti-

asthmatic. It is also used in bleeding hemorrhoid disorder, dysmenorrheal, hydrocele, liver disorders, gonorrhoea, wound, worm infections, scorpion sting, cough and cold (Kirtikar et al., 1935; Kala, 2004). Stem bark powder is used to apply on injury caused due to axe. Stem juice is applied on goitre of human being. Paste of stem bark is applied in case of body swellings. Bark is acrid, bitter, appetiser, aphrodisiac and laxative, anthelmintic, useful in fractures of the bones, diseases of theanus, dysentery, piles, hydrocele, cures ulcers and tumors. Bark is useful in biliousness, dysmenorrhea, liver disorder, gonorrhoea and it also purifies the blood. The ash of young branch is prescribed in combination with other drugs in case of scorpion sting (Cherdshewasart et al., 2003).

Root is used in night blindness, elephantiasis, and impotency in snake bite. It also causes momentary sterility in women and is applied in sprue, piles, ulcers, tumors and dropsy. The root cures night blindness and other defects of sights, useful in

Table 3. Pharmacological Activities of *Butea monosperma* (Lam.) Kuntze

Activity	Plant part used	Details
Anticonceptive	Seeds	Oral administration to adult female rats at the doses of 5, 10 and 20 mg/rat from day 1 to day 5 of pregnancy showed anti-implantation activity in 40%, 70% and 90% of the treated animals, respectively. At lower doses, there was a dose-dependent termination of pregnancy and reduction in the number of implantation sites (Bhargava, 1986; Pandey, 2001).
Antidiabetic	Flowers, Seeds	The single ethanolic extract of dose 200 mg/kg P.O. significantly improved glucose tolerance and cause reduction in blood glucose level in alloxan induced diabetic rats. Oral administration of the ethanolic extract of the seeds at the dose of 300mg/kg b.w., exhibited significant antidiabetic, hypolipaemic and antiperoxidative effects in non-insulin dependent diabetes mellitus rats (Somani et al., 2006; Sharma et al., 2009; Bavarva et al., 2009; Akhtar, 2010).
Anthelmintic	Seeds	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 maximum reduction of 78.4% in eggs per gram of feces was recorded on day 10 after treatment with 3 g/kg. Levamisole (7.5 mg/kg), a standard anthelmintic agent, exhibited 99.1% reduction in eggs per gram. The anthelmintic activity of different species of <i>Butea</i> has been reported against <i>Ascaridia galli</i> , <i>Ascaris lumbricoides</i> , <i>Earthworms</i> , <i>Toxocara canis</i> , <i>Oxyurids</i> , <i>Dipylidium caninum</i> (Prashanth et al., 2001).
Antiesterogenic and antifertility	Flowers, Seeds, Bark	Hot alcoholic extract of <i>Butea monosperma</i> 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. Butin also exhibits male contraceptive properties. Antifertility effect of seed extract of <i>Butea frondosa</i> has also been reported in mice. The stem bark of <i>Butea monosperma</i> , led to the isolation and identification of three new compounds named buteaspermin A, buteaspermin B and buteaspermanol, along with 19 known compounds (Bhargava, 1986; Dixit et al., 1981; Razdan et al., 1970; Maurya et al., 2009).
Antitumor	Flowers	Intraperitoneal administration of the aqueous extract of flowers of <i>Butea monosperma</i> in the X-15-myc onco mice showed antitumorigenic activity by maintaining liver architecture and nuclear morphometry but also down regulated the serum VEGF levels. Immuno-histochemical staining of liver sections with anti-ribosomal protein S27a antibody showed post-treatment abolition of this proliferation marker from the tumor tissue (Sharma et al., 2011).
Antimicrobial, Antifungal and antibacterial	Bark, Seed	The stem bark of <i>Butea monosperma</i> displays antifungal activity, which is due to the presence of an active constituent medicarpin. The seed oil of <i>Butea monosperma</i> shows significant bactericidal and fungicidal effect in in-vitro testing (Bandara et al., 2001; Mehta et al., 1981).
Anti-diarrhoeal	Stem Bark	Ethanolic extract of stem bark of <i>Butea monosperma</i> (Lam) Kuntz at 400 mg/kg and 800 mg/kg inhibited 868 castor oil induced diarrhoea due to inhibiting gastrointestinal motility and PGE2 induced enteropooling and it also reduced gastrointestinal motility after charcoal meal administration in Wistar albino rats. <i>Butea monosperma</i> gum has also been found useful in cases of chronic diarrhoea. It is a powerful

		astringent and also decreases bilirubin level (Gunakkunru et al., 2005; Ramana et al., 2000).
Antistress	Flowers	Water soluble part of ethanolic extract of flower attenuated water immersion stress, induced elevation of brain serotonin and plasma corticosterone levels. The ulcer index also decreased in dose dependent manner. Observed effects may be attributed to its nonspecific antistress activity (Bhatwadekar et al., 1999).
Giardiasis	Stem, Root, Flower, Leaves	Giardiasis is a common gastrointestinal infection caused by a protozoa1 parasite, <i>Giardia lamblia</i> . Pippali rasayana (PR), an Ayurvedic herbal medicine, prepared from <i>Piper longum</i> (Pippali) and <i>Butea monosperma</i> (Palash) in which ash of stem, root, flower and leaves of <i>Butea monosperma</i> 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 (Guha et al., 1990). Flowers of this plant are also effective in leprosy, leucorrhoea and gout (The Wealth of India-Raw Materials., 1988).
Radical scavenging	Flowers	Ethyl acetate, butanol and aqueous fractions derived from total methanol extract of <i>Butea monosperma</i> flowers were evaluated for radical scavenging activities 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 erythrocyte hemolysis using 2, 2' azo-bis (amidinopropane) dihydrochloride (AAPH). Methanol extract along with its ethyl acetate and butanol fractions showed potent free radical scavenging activity, whereas aqueous fraction was found to be devoid of any radical scavenging properties. The observed activity could be due to the higher phenolic content in the extracts (16.1, 25.29, and 17.74% w/w in methanol extract, ethyl acetate and butanol fractions respectively) (Sehrawat et al., 2006).
Anticonvulsive	Leaves , Flowers	It shows anticonvulsive activity, due to the presence of a triterpene (Kasture et al., 2002). The ethanolic extracts of leaves of albizzia lebbeck and flowers of hibiscus Rosa sinesis and the petroleum ether extract of flowers of <i>Butea monosperma</i> exhibited anticonvulsant activity. The acetone soluble part of petroleum ether extract of <i>Butea monosperma</i> 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 (Kasture et al., 2000).
Anti-inflammatory	Leaves	The leaves of <i>Butea monosperma</i> exhibit ocular antiinflammatory activity in rabbits (Mengi et al., 1995). The antiinflammatory activity of methanolic extract of <i>Butea monosperma</i> 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% (Shahavi et al., 2008).
Wound healing	Stem Bark	The topical administration of an alcoholic bark extract of <i>Butea monosperma</i> 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. <i>Butea monosperma</i> exhibited wound healing activities due to its antioxidant properties (Sumitra et al., 2005).
Hemagglutinating	Seeds	Seeds of <i>Butea monosperma</i> showing specificity towards human erythrocytes. The lectins such as <i>Butea monosperma</i> agglutinin (BMA) isolated from the seeds of <i>Butea monosperma</i> are responsible for agglutinating property; 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 (Sehrawat et al., 2006).
Liver Disorders	Flowers	An extract from the flowers of <i>Butea monosperma</i> is used in India for the treatment of liver disorders and two antihepatotoxic flavonoids, isobutrin and butrin have been isolated from the extract (Wagner et al., 1986). The effect of pretreatment of methanolic <i>Butea monosperma</i> extract prior to taa treatment at two doses and the results suggest that it may contribute to the chemo preventive effect. <i>Butea monosperma</i> 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 (Sehrawat et al., 2006).
Thyroid inhibitory, antiperoxidative and hypoglycemic effects	Stem Bark	Stigmasterol, isolated from the bark of <i>Butea monosperma</i> was evaluated for its thyroid hormone and glucose regulatory efficacy in mice by administrating 2.6 mg/kg/d for 20 days which reduced serum triiodothyronine (T3), thyroxin (T4) and glucose concentrations as well as the activity of hepatic <i>glucose-6-phosphatase</i> (G-6-Pase) with a concomitant increase in insulin indicating its thyroid inhibiting and hypoglycemic properties. A decrease in the hepatic lipid peroxidation (LPO) and an increase in the activities of catalase (CAT), superoxide dismutase (SOD) and glutathione (GSH) suggested its <i>antioxidative</i> potential. The highest concentration tested (5.2 mg/kg) evoked pro-oxidative activity (Maurya et al., 2009).
Hepatoprotective	Flowers	Oral administration of <i>Butea monosperma</i> flowers powder (100 mg/kg) effectively inhibited paracetamol induced changes in the serum marker enzymes in rabbits. Increase in transaminases aspartate transaminase, alanine transaminase and alkaline phosphatase was observed with paracetamol treated group. The results suggest that the BM flowers powder possessed significant potential as hepatoprotective agent. Isobutrin and butrin, the antihepatotoxic principles of flowers was reported and this activity was monitored by means of ccl4 and gain-induced liver lesion <i>invitro</i> . The methanolic extract of <i>B. monosperma</i> possesses hepatoprotective effects and also it might suppress the promotion stage via inhibition of oxidative stress and polyamine biosynthetic pathway by significant reduction in thioacetamide-induced serum aspartate transaminase, alanine transaminase (alt/sgpt), lactate dehydrogenase and gamma-glutamyltranspeptidase activities (Wagner et al., 1986).

elephantiasis. Root pieces are heated and then 2-3 spoons of extract are advised at night as a remedy against impotency and it is administered for one month. Spoonful of root powder mixed with water is drunk as an antidote for snake bite (Nadkarni's, 2002).

Seed of *B. monosperma* is used in inflammation, skin and eye diseases, bleeding piles, urinary stones, abdominal troubles, intestinal worms and tumour (Bhalla et al., 1999; Nadkarni's, 2002). When seeds are pounded with lemon juice and applied to the skin, they act as a rubefacient. Powdered seeds are consumed by children as remedy against intestinal worms. Seeds are crushed in milk and this mixture about 2 spoons is taken orally to treat urinal complaints and also against urinary stones. Fruit and seed are digestible, aperient, cure 'Vata' and 'Kapha', skin diseases, tumors and abdominal troubles as per Ayurveda are given for Scorpion-sting (Bandara et al., 1990). Fruit and seed are useful in piles, eye diseases and inflammation. When pounded with lemon juice and applied seeds act as powerful rubefacient and they have been effectively used in curing a form of herpes, known as Dhobie's itch.

Gum is used in stomatitis, corneal opacities, ring worm, leucorrhoea, septic sore throat, excessive perspiration and diarrhea (Kirtikar et al., 1935). Gum is applied for cracks on foot sole. 2 spoons of diluted gum are advised for dysentery until cure. Gum is astringent to bowel, good in stomatitis, cough, pterygium, corneal opacities and cures excessive perspiration (Bhalla et al., 1999).

Conclusion

Herbs have constantly been the principal form of medicine in India and currently they are becoming well-liked all over the world, as community 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 defense. *Butea monosperma* is one of the vital multipurpose trees used for medicine, food, fiber and few other miscellaneous purposes. The crude extracts of diverse parts and pure isolates of *Butea monosperma* was reported to acquire antistress, wound healing, antidiabetic, antibacterial, antifungal, hypoglycemic, anti-inflammatory activities etc. It has been found to possess tonic, astringent, aphrodisiac and diuretics properties. It is also remarkable to note that all parts of this tree are

employed for a variety of purposes by the rural folks and aborigines in the region. This demonstrates that the tree is boon for indigenous peoples. The widespread uses of *Butea monosperma* in traditional systems of medicine have resulted in their extensive chemical analysis for their bio-active principles. Hence the information collected was useful for a multidisciplinary team of botanists, ethnobotanists, pharmacologists, physiochemists, and medicinal experts for further pharmacological and therapeutical evaluation which can help in proving it to be a promising source in pharmaceutical as well as nutraceutical industry.

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