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A Comprehensive review on *Butea monosperma* (Lam.) Kuntze

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ABSTRACT

Butea monosperma (Lam.) is an indispensable tree. Tribals use its flowers and young fruits. The plant is used in Ayurvedic, Unani and Siddha medicine for various ailments. Almost all the parts of the plant namely root, leaves, fruit, stem bark, flowers, gum, young branches are used as medicine, food, fibre and for other miscellaneous purposes such as fish poison, dye, fodder, utensils, etc. About 45 medicinal uses are associated with the plant and out of these claims almost half the number of claims have been scientifically studied and reported. These observations are noteworthy for further studies on modern scientific lines.

KEYWORDS: *Butea monosperma*, traditional uses, scientific reports, review.

INTRODUCTION

Butea monosperma (Lam.) is commonly known as Flame of forest, belongs to the family Fabaceae (1). It is locally called as palas, palash, mutthuga, bijasneha, dhak, khakara, chichra, Bastard Teak, Bengal Kino, Nourouc and is common throughout India, Burma and Ceylon except in very acrid parts. Generally it grows gregariously on open grasslands and scattered in mixed forest. Plantations can be raised both on irrigated and dry lands. The pods should be collected and sown before the commencement of rains, root suckers are freely produced and help in vegetative propagation. In India, *palas* ranks next to *kusum* (*schleichera trijuga*) as a host tree for lac insect (2, 3). Almost all the parts of the plant are being used since decades in medicine and for other purposes. These days herbal medicines are more popular than modern medicine because of their effectiveness, easy availability, low cost and for being comparatively devoid of side effects. Nature always stands a golden mark to exemplify the outstanding phenomenon of symbiosis and it has provided the storehouse of remedies to cure all ailments of mankind, only the thing is that there is a need to evaluate them scientifically.

Butea monosperma (Lam.) kuntze is one among four species belonging to the genus Butea Koenig, three species of which occur in India (4). It holds an important place because of its medicinal and other miscellaneous uses of economic value. Bark fibers are obtained from stem for making cordage (2). Stem bark powder is used to stupefy fishes. Young roots are used for making ropes (4). Green leaves are good fodder for domestic animals. Leaves are used for making platters, cups, bowls and beedi wrappers (4, 5). Leaves are also used for making Ghongda to protect from rains and are eaten by buffaloes and elephants. Tribals use flowers and young fruits as vegetables. Flowers are boiled in water to obtain a dye (1). Orange or red dye is used for colouring garments and for making skin antiseptic ointments (6). Fresh twigs are tied on horns of bullocks, on occasion of 'pola' and dry twigs are used to feed the sacred fire (1). In addition wood of the plant is mainly used for well-curbs and water scoop. It is also employed as a cheap board wood and for structural work, wood pulp is suitable for newsprint manufacturing (5).

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 3.8-5 cm 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-canescent : stalked 2 cm long (2,4).

Fig. 1 Butea monosperma (Lam.) Kuntze

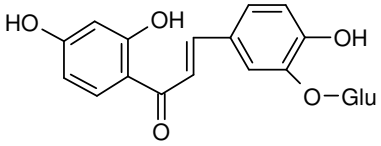
Fig. 2. Butea monosperma (Lam.) Kuntze (A) – Flowers, (B) – Leaves

Phytochemistry

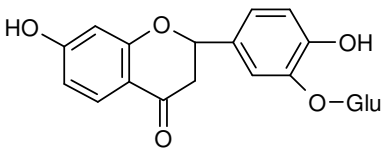
Flower: Triterpene (7), butein, butin, isobutrin, coreopsin, isocoreopsin (butin 7-glucoside), sulphurein, monospermoside (butein 3-ß-D-glucoside) and isomonospermoside, chalcones, aurones, flavonoids (palasitrin, prunetin) and steroids (8, 9).
Gum: Tannins, mucilaginous material, pyrocatechin (4).
Seed: Oil (yellow, tasteless), proteolytic and lypolytic enzymes, plant proteinase and polypeptidase. (Similar to yeast tripsin) (4).
A nitrogenous acidic compound, along with palasonin is present in seeds (9). It also contains monospermoside (butein 3-ß-D-glucoside) and somonospermoside. From seed coat allophanic acid has been isolated and identified (10, 11).
Resin: Jalaric esters I, II and laccijalaric esters III, IV.; α-amyrin, ß-sitosterone its glucoside and sucrose; lactone-n-heneicosanoic acid-δ-lactone (11,12).
Sap: Chalcones, butein, butin, colourless isomeric flavanone and its glucosides, butrin (4).
Leaves: Glucoside, Kino-oil containing oleic and linoleic acid, palmitic and lignoceric acid (13).
Bark: Kino-tannic acid, Gallic acid, pyrocatechin (13). The plant also contains palasitrin, and major glycosides as butrin, alanind, allophanic acid, butolic acid, cyanidin, histidine, lupenone, lupeol, (-)-medicarpin, miroestrol, palasimide and shellolic acid (13,14, 15, 16, 17, 18, 19, 20).
Stem: 3-α-hydroxyeuph-25-ene and 2,14-dihydroxy-11,12-dimethyl-8-oxo-octadec-11-enylcyclohexane (21).
Stigmasterol-ß-D-glucopyranoside and nonacosanoic acid (22).

Table. 1 Taxonomy, Geographical distribution and Ayurvedic description.

Plant	**Kuntze**
Taxonomical classification (40)	
Kingdom	Plantae, Plants.
Phylum	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae
Tribe	Phaseoleae
Genus	*Butea*
Synonyms	*Butea braamania* DC; *Butea frondosa* Roxb; *Butea frondosa* Willd; *Butea frondosa* Willd. var. *lutea* (Witt.)Maheshw; *Plaso monosperma* (Lam.) Kuntze; *Plaso monosperma* (Lam.) Kuntze var. *flava* Kuntze; *Plaso monosperma* (Lam.) Kuntze var. *rubra* Kuntze.
Geographical distribution (40)	Asia: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Java, Laos, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam. India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Dadra-Nagar-Haveli, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu-Kashmir, Karnataka, Kerala, Madhaya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.
Parts used (3)	Flowers, seeds, fruits, leaves, gum and bark are used.
Ayurvedic description (3)	**Sanskrit:** Palasa. **Common general properties** *rasa–katu, tikta, kasaya; guna-laghu, snigdha; veerya-ushana; vipak-katu.* **Action and uses** Kapha vat samak, kaoha pitta samak, lakhan, soth har, badana sthapan, dipan, grahi, anuloman, dah prasaman, rat stambham, rakt sodhan, veersya, rasayan.



Monospermoside
(Ref. No. 11)



Isomonospermoside
(Ref. No. 11)

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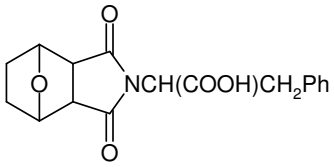
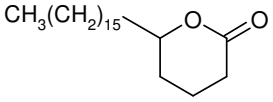
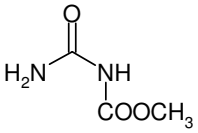


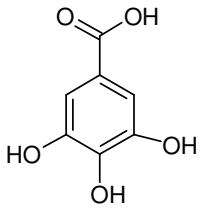
Palasonin
(Ref. No.11)



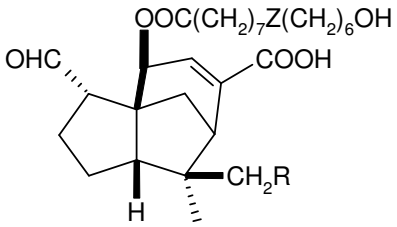
Lactone-n-heneicosanoic acid-δ-lactone
(Ref. No. 11)



Allophanic acid (Methyl ester)
(Ref. No. 9)



Gallic acid
(Ref. No. 13)



Ref No. (11)

Jalaric ester I
R = OH, Z = CH = CH

Jalaric ester II
R = OH, Z = $(CHOH)_2$

Laccijalaric ester III
R = H, Z = CH = CH

Laccijalaric ester IV
R = H, Z = $(CHOH)_2$

CLAIMS AND REPORTS

Flowers: Flowers are astringent to bowel, increase "Vata" cure "Kapha", leprosy, strangury, gout, skin diseases, thirst, burning sensation; flower juice is useful in eye diseases. Flower is bitter, aphrodisiac, expectorant, tonic, emmenagogue, diuretic, good in biliousness, inflammation and gonorrhoea. The dye is useful in enlargement of spleen. Flowers are depurative, as a poultice they are used to disperse swelling and to promote menstrual flow. They are given to pregnant women in case of diarrhoea. It is also useful to prevent 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 reduce 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 (1, 2).

Mishra et al., evaluated free radical scavenging activity of various extracts of flowers by using different in-vitro models like reducing power assay, scavenging of 2,2 diphenyl-1-picrylhydrazyl (DPPH) radial, nitric oxide radical, super oxide 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).

Kasture et al. reported antistress activity of flowers. Water soluble part of ethanolic extract 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 (23).

Kasture et al. reported anticonvulsive activity of flowers. The anticonvulsive principle was found to be a triterpene present in the n-hexane : ethyl acetate (1:1) fraction of the petroleum ether extract. Triterpene exhibited anticonvulsant activity against seizures induced by Maximum Electro Shock (MES), it also inhibited seizures induced by pentylene tetrazole, electrical kindling and the combination of lithium sulphate and pilocarpine nitrate. Further studies are required to investigate its usefulness in the treatment of epilepsy (7).

Wagner H. et al. reported Isobutrin and Butrin, the antihepatotoxic principles of flowers. Activity was monitored by means of CCl_4 and GalN-induced liver lesion in-vitro. The antihepatotoxic principles isolated consisted of two known flavonoids, isobutrin (3, 4, 2', 4'-tetrahydroxychalcone-3, 4'-diglucoside), and the less active butrin (7, 3', 4'-trihydroxyflavanone-7, 3'-diglucoside) (24).

Kasture et al. reported effect of flowers in memory and behaviour mediated via monoamineneurotransmitters. The

acetone soluble part of petroleum ether and ethanolic extract exhibited nootropic activity in the elevated plus maze paradigm and active avoidance learning (25).

Mishra M. et al., reported the presence of flavonoids in ethyl acetate fraction of methanol extractives (26).

Shah K.G. et al. reported phytochemical studies and antiestrogenic activity of flowers. Phytochemical investigations of the dried flowers of *Butea frondosa Roxb* revealed the presence of atleast seven flavones and flavonoid constituents including butrin and isobutrin and also four free amino acids. Purified alcoholic extract at lower dose level and ethereal and water extracts at higher dose level have been found to exhibit significant antiestrogenic activity in immature mice, while ethyl acetate extract containing butrin and isobutrin exhibited poor activity. Significant inhibition of uterus weight gain, vaginal epithelium cornification and characteristic histological changes have been observed (27).

Gupta S.R. et al. carried out a reinvestigation of the flowers of *Butea monosperma* and revealed the presence of seven flavonoid glucosides. Two of them are butrin and isobutrin, which have been isolated earlier from the plant. Three glucosides have been identified as coreopsin, isocoreopsin and sulphurein. The remaining two are new and have been assigned the structures (monospermoside) and (isomonospermoside) (11).

Shah K.C. et. al. isolated and identified free sugars and free amino acids from the petroleum ether extract of flowers (28).

Seeds: 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, tumours, abdominal troubles and as per Ayurveda are given for Scorpion-sting. 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 successfully used in curing a form of herpes, knows as Dhobie's itch (1, 2, 4).

Prashant D. et al, reported in-vitro anthelmintic activity of methanol extract of seed (29). Pandey H.P. et al. reported the use of seed oil as traditional sexual toner and contraceptive (30). Singh A.N. et al. reported components of soft resin. They isolated four essentially pure acid esters, which together constitute the bulk of soft resin. They termed these acid esters, jalaric ester-I, jalaric ester-II, laccijalaric ester-I and laccijalaric ester-II (31).

Bhargava S.K. isolated butin from the seed and reported anti-implantation activity in rats (32).

Leaves: Leaves are good 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 irregular bleeding during menstruation (1, 2). Mishra M. et al. reported 3,9-dimethoxypterocapan from ethyl acetate fraction of methanol extractives from leaves. And hexane fraction of methanol extractives yielded 3-alpha-hydroxyeuph-25-enylheptacosanoate (33).

Gum: 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 (1, 2).

Roots: The root cures night blindness and other defects of sights, useful in elephantiasis. Root pieces are heated and then 2-3 spoons of extract is 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 (1, 2).

Bodakhe S.H. et al. reported in-vitro lens protective and antimicrobial activity of roots (34).

Stem bark: 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, laxative, anthelmintic, useful in fractures of the bones, diseases of the anus, dysentery, piles, hydrocele, cures ulcers and tumours. 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 (1, 2). Savitri N.K. et al. reported antifungal constituents from petroleum and ethyl acetate extracts of stem bark. Extract exhibited significant antifungal activity against C. cladosporiodes (35).

Sharma S.K. et al. reported antidiarrhoeal potential of ethanolic extract in castor oil induced diarrhoea model, PGE2 induced enteropoolingin in rats. Extract also reduced gastrointestinal motility after charcoal meal administration (36). Suguna L. et. al. investigated the effect of alcoholic bark extract on cutaneous wound healing in rats. Excision wounds were made on the back of rat and extract was applied topically. The granulation tissue formed on days 4, 8, 12 and 16 (post-wound) was used to estimate total collagen hexosaamine, protein, DNA and uronic acid. Further epithelialization and wound contraction was confirmed by histopathalogical examination (37).

In ancient Ayurvedic literature extensive mention of this drug is available in the treatment of *Krimi Roga* (worm infestations). It enters into the composition of some very important and widely used recipes of Ayurvedic medicines used in the treatment of *Krimi Roga*. In *Sushruta samhita* this drug has been described under four different groups of herbal medicines eg. *Rudaradigana, Musakadigana, Amabasatadigana and Nyagrodhabigana dealing with different disorders* eg. *Medoroga, Striroga, Prameha* and also credited with *Kapha and Pittanasak* properties. The first mention of its *Krimighna* property is available in *Sushruta samhita* and the later Ayurvedic authors have also described its efficacy in *Netraroga* and its astringent action in different conditions. In ancient and later Ayurvedic literature this drug has been mentioned either alone or as a constituent of many prepared medicines used in the treatment of *Krimi Roga* (38). A clinical trial of the plant in worm infestation proved its effectiveness in cases of round worm and thread worm infestations and the

drug was found to be ineffective in the only case of tapeworm infestation. Agarwal A.K. et.al. reported use of "Ayurvedic Rasayana" (herbal medicine) containing *Butea monosperma* in the management of giardiasis perhaps by immunomodulation as the "Rasayana' did not exhibit killing effect on the parasite in-vitro (39).

SUMMARY AND CONCLUSION

In the present review we have congregated information pertaining to botanical,phytochemical,nutritional,traditional claims and recent studies. The tree has immense potential and appears to have a broad spectrum of activity on several ailments. Various parts of the plant have been explored for antioxidant, antidiarrhoeal, dermal wound healing, antidiabetic, antistress, anticonvulsive, antihepatotoxic, nootropic, antiestrogenic and anthelmintic activities. In addition root is lens protective and antimicrobial. Isolation, identification of the diverse chemical constituents are in progress. A clinical trial of the plant in worm infestation proved its effectiveness in cases of round worm and thread worm infestations and the drug was found to be ineffective in the only case of tapeworm infestation. An Ayurvedic formulation containing *Butea monosperma* as one of the constituents is used in the treatment of giardiasis. A number of reports are available with respect to antihepatotoxic potential of flower and seed of *Butea monosperma*. Utility of flower, seed, fruit, leaves against various eye ailments are not extensively evaluated by scientific means. Plant has immense potential as antidote and in symptomatic treatment of either snake bite or scorpion sting. There are traditional claims for usefulness of young branches, stem bark and seed of *Butea monosperma* in snake bite and scorpion sting, if these claims are scientifically evaluated they may prove to be a good remedy against the same.

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