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A Comprehensive review on Pharmacological Profile of *Butea monosperma* (Lam.) Taub

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ABSTRACT

Butea monosperma (Lam.) Taub belong to family Fabaceae, widely distributed in India and in all Asian hemispheres. It is a plant that has been electively used in traditional Asian medicines for centuries. It has been used for the treatment of different ailments such as cancer, diabetes, diarrhoea, dysentery, fever and jaundice. Recent *in vivo* and *in vitro* studies have indicates its anti-diabetic, anti-cancer, anti-inflammatory, anti-asthmatic, anti-oxidant, anti-convulsant, anti-microbial, anti-viral and hepatoprotective properties. The aerial part of the plant contains a large number of phytochemicals mainly flavonoids, lactones, diterpenoids, diterpene glycosides and phytosterols. This review will discuss the recent findings on the mechanisms, traditional and folk medicinal uses and remarkable biological activity of *Butea monosperma*.

INTRODUCTION

Relationship between human and medicinal plants have been emphasized by Ayurveda since the origin of mankind. Humans have depended on plants for their basic needs such as food-stuffs, shelters, clothing, fertilizers, flavors and fragrances and medicines (Gurib-Fakim, 2006).

Ayurveda is one of the oldest medical systems in the world, providing innumerable leads to find active and therapeutically useful compounds for drug development from plants. Currently, the use of herbal medicines is wide spread in developing as well as developed countries due to its natural source and limited adverse effects (Ekor, 2013).

Medicinal plant drug discovery continues to provide new and important leads against various pharmacological targets including diabetes, cancer, malaria, cardiovascular diseases and neurological disorders (Ramawat *et al.*, 2009). Interest in herbal drugs and natural medicine is undergoing a renaissance at the present time.

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There are number of medicinal plants in Ayurveda that are recommended for the treatment of various disorders, one of them being *Butea monosperma* (Lam.) Taub commonly known is 'Flame of forest' and Bastard Teak. It is a medium- sized tree belonging to family *Fabaceae*.

This tree has long been known to the Hindus under the Sanskrit name of palasha, as possessing precious therapeutic properties. Almost all the parts of *Butea monosperma* are being used since decades in medicine and for other purposes. It is considered as a good source of gum, resin, food, fibre, dye and traditionally being use for the treatment of number of diseases such as cancer, diabetes diarrhoea and dysentery (Burlia *et al.*, 2007).

The other genus of *Butea* includes *Butea monosperma*, *Butea frondosa*, *Butea parviflora*, *Butea superba* and widely distributed throughout India (Khare, 2007). The aim of the current review is to discuss the taxonomy, phytochemistry and pharmacology of *Butea monosperma* (Lam.) Taub.

TAXONOMY

Scientific Name (Khare, 2007)

Butea monosperma (Lam.) Taub (Synonym Name- *Butea frondosa* Koenig ex Roxb)

Vernacular Name (The Ayurvedic Pharmacopoeia)

Paalasha, Kimshuka, Raktapushpaka (Ayurvedic); Dhaak, Samagh Dhaak, Kamarkas (Unani); Palasam, Purasus (Tamil); Kimsuka, Brahma Vrksa, Karaka (Sanskrit); Flame of forest, Parrot Tree (English); Palas, Tesu, Dhak (Hindi); Kimsuk (Bengali); Keshu (Punjabi); Moduga (Telugu); Kesudo (Gujarati); Palashpapra (Urdu); Muthuga (Kannada.); Pangong (Manipuri)

Botanical Classification (The Ayurvedic Pharmacopoeia)

Kingdom	Plantae
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae
Genus	Butea
Division	Magnoliophyta
Species	Monosperma (Lam.) Taubert

DISTRIBUTION

Butea monosperma (Lam.) Taub is a medium-sized deciduous tree growing throughout India, South Asia, Indonesia, Japan, Laos, Myanmar, Nepal, Sri Lanka, Thailand and Vietnam. It is commonly found up to an altitude of 1200 m except in very arid regions (Khare, 2007). Generally it grows gregariously on open grasslands and scattered in mixed forest. Plantations can be raised both on irrigated and dry lands. It grows on a wide variety of soils including shallow, gravelly sites, black cotton soil, clay loams, and even saline or waterlogged soils. Seedlings thrive best on a rich loamy soil with pH 6-7 under high temperature and relative humidity (Burlia *et al.*, 2007; Hocking, 1993).

DESCRIPTION

Butea monosperma (Lam.) Taub is an erect, slow growing, deciduous tree reaching 5 to 8 m with a crooked trunk and irregular branches (Figure 1).

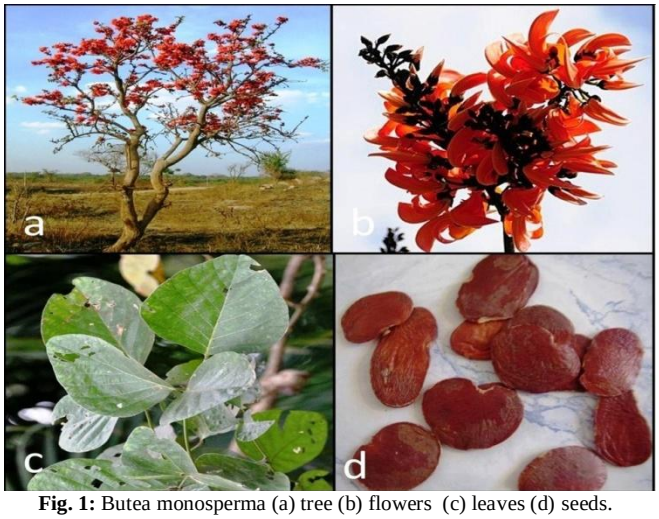

Fig. 1: Butea monosperma (a) tree (b) flowers (c) leaves (d) seeds.

It attains a diameter of about 20 to 40 cm when it matures at the age of about 50 years (Rana *et al.*, 2012). The leaves are large, stipulate and 3-foliate. Leaflets are obtuse, glabrous above, finely silky and conspicuously reticulately veined beneath with cunnate or deltoid base. Flowers are large, bright crimson orange colour and 2 to 4 cm in diameter. It start appearing in february and stay on nearly up to the end of April. Pods are stalked 12.5-20 by 2.5-5 cm, thickened at the sutures, reticulately veined argenteo–canescent: stalk 2 cm long (Burlia *et al.*, 2007). The seeds are flat, kidney shaped, 25 to 40 mm long, 1 to 3 mm wide, and 1.5 to 2 mm thick. It is dark reddish-brown in colour, thin, glossy; hilum clear, situated near middle of seed; odour, faint; taste, slightly acrid and bitter (The Ayurvedic Pharmacopoeia).

AYURVEDIC PREPARATION

Butea monosperma (Lam.) Taub is used as one of the important ingratiates in most commonly used Ayurvedic preparations such as Kunkumadi Taila, Vanda Bhasma, Krmimudgara Rasa, Ayaskrti and Palasa Arka (The Ayurvedic Pharmacopoeia).

TRADITIONAL USES

As per the ancient Ayurvedic text book Charaka Samhita, seeds of *Butea monosperma* are insecticidal and Ayurvedic physicians used them to compound medicines for diarrhoea and dysentery. Juice made from the *Butea monosperma roots*, bark, and leaves are administered for regulating menstrual flow, colic and intestinal worms. The ointment made from the leaves is useful for boils, pimples, swellings, and for shrinking haemorrhoids. Flowers of *Butea monosperma* are useful as astringent, depurative and tonic (Patnaik, 1993).

CHEMISTRY

Butea monosperma flowers are known to contain flavonoids and glucosides. Butin, isobutrin and butein are main phytoconstituents of flowers. Chalcones, aurones, isobutyine, palasitrin, coreopsin, isocoreopsin (butin 7-glucoside), monospermoside and triterpene steroids are the other phytoconstituents present in the flower (Basu *et al.*, 1999; Mishra *et al.*, 2000). It also contains myricyl alcohol, stearic, palmitic, arachidic, lignoceric acids, glucose, fructose, phenylalanine, aspartic acid, alanine and histidine (Sindhia *et al.*, 2010). Roots contain glucose, glucosides, glycine, and aromatic compounds (Parashar *et al.*)The seed oil contains proteolytic and lypolytic enzymes, plant proteinase and polypeptidase. Seeds also contain butin, monospermoside, α-Amyrin, β- sitosterol and β-sitosterol-β-D-glucoside (Bhargava, 1986). Bark contains various tannins like Kino-tannic acid, pyrocatechin. It also contains gallic acid, butolic acid, palasitrin, butrin, alanind, allophanic acid, cyanidin, histidine, lupenone, lupeol, miroestrol, medicarpin, shellolic acid and palasimide (Nadkarni, 1976). Leaves contain glucoside, linoleic acid, palmitic lignoceric acid, 3-alphahydroxyeuph- 25-enylheptacosanoate and 3,9-dimethoxypterocapan (Mishra *et al.*, 2000). Gum contains tannins, pyrocatechin and mucilaginous material (Kirtikar *et al.*, 1918) (Figure 2).

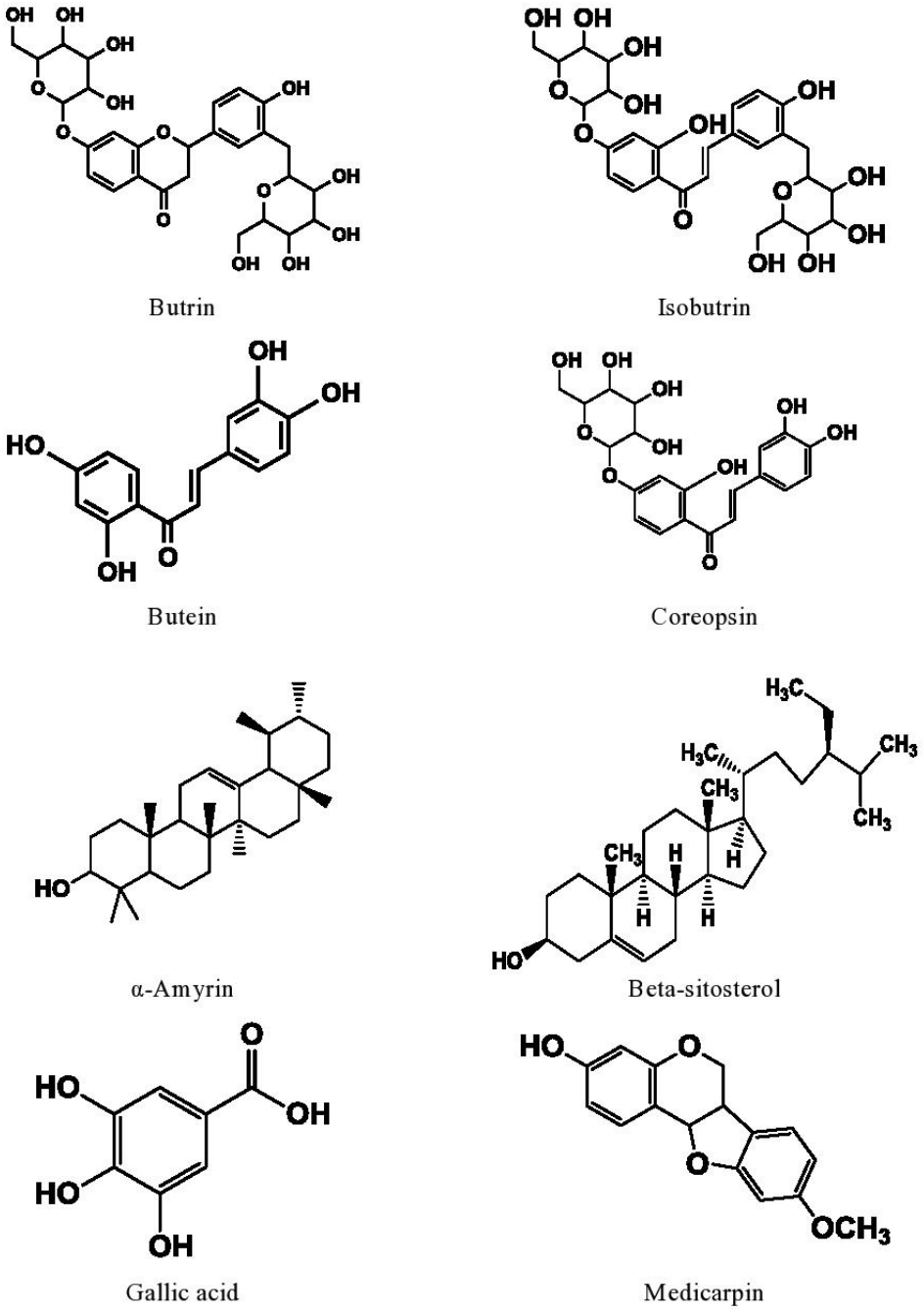

Fig. 2: Chemical structure of the biologically active compounds of *Butea monosperma.*

PHARMACOLOGICAL ACTIVITY

Anti-diabetic

Ethanolic extract of *Butea monosperma* flowers significantly reduced blood glucose, serum cholesterol, improved HDL-cholesterol and increased the activities of antioxidant enzymes (Somani *et al.,* 2006), (Talubmook *et al.,* 2014), (Sharma *et al.,* 2009). Similarly, methanolic extract of *Butea monosperma* flowers showed lipid lowering and anti-diabetic activity against high fat diet and streptozotocin induced diabetes in rats (Parveen *et al.,* 2011). The n-butanolic fraction of *Butea monosperma* flowers significant decreased the dexamethasone induced hyperglycemia and hyperlipidemia in mice (Jamkhande *et al.,* 2010). The ethanolic extract of *Butea monosperma* leaves elevated blood insulin level in Type 2 diabetic rats, stimulated insulin secretion in isolated rat islets, and enhanced hepatic glycogen formation. (Samad *et al.,* 2014).

The leaves and stem bark of *Butea monosperma* showed significant anti-diabetic activity using various *in vitro* techniques viz. glucose adsorption, diffusion, amylolysis kinetics, enteric enzymes and glucose transport across yeast cells (Harish *et al.,* 2014). The aqueous extract of *Butea monosperma* bark (Yadav *et*

al., 2012), ethanolic extract of bark (Divya *et al.,* 2014) and seeds (Bavarva *et al.,* 2008) showed anti diabetic and lipid lowering activity in the rats. In addition, stigmasterol isolated from the bark of *B. monosperma* significantly reduced serum triiodothyronine, thyroxin, glucose and hepatic glucose-6- phophatase levels with a concomitant increase in insulin level (Panda *et al.,* 2009). The oral administration of powder of *Butea monosperma* fruits at different dosage significantly reduced blood glucose, urine sugar, total lipids, LDL cholesterol and increased HDL cholesterol in both normal and diabetic subjects (Akhtar *et al.,* 2010).

Table 1: Pharmacological effects of *Butea monosperma* (Lam.) Taub.

`Pharmacological Activity	**Plants Parts**	**Extract/Fractions**	**Doses**	**References**
`Anti-diabetic	Flowers	Ethanolic extract	200 mg/kg × 2 weeks 250 mg/kg × 8 weeks 300 mg/kg × 45 days	Somani *et al.,* 2006 Talubmook *et al*., 2014 Sharma *et al.,* 2009
		Methanolic extract n-butanolic fraction	300 mg/kg × 4 weeks 100g and 200 mg/kg × 22 days	Parveen *et al.*, 2011 Jamkhande *et al.*, 2010
	Leaves	Ethanolic extract	2.5 g/10 mL per kg body weight	Samad et al., 2014
	Leaves and Stem bark	Aqueous extracts	1–5 mg / 1 mL of glucose solution (*In vitro*)	Harish *et al.*, 2014
	Bark	Aqueous extract Ethanolic extract Isolated stigmasterol	1.25mg × 4 weeks 500 mg/kg for 60 days 2.6 mg/kg ×20 days	Yadav *et al.*, 2012 Divya *et al.*, 2014 Panda *et al.*, 2009
	Seeds	Ethanolic extract	300mg/kg × 4 weeks	Bavarva *et al.*, 2008
	Fruits	Powder	1g, 2g and 3g/30ml for 30 days	Akhtar *et al*., 2010
Anti-inflammatory	Flowers	Hydroalcoholic extract and butrin, isobutrin enriched fraction	2.5 mg/mL and 0.39 mg/ml respectively	Krolikiewicz-Renimel *et al.,* 2013
		Isobutrin and butein	1–60 µg/ml for 2 h	Rasheed *et al.,* 2010
		Methanolic extract	600 and 800 mg/kg (one-hour prior)	Shahavi *et al.*, 2008
	Bark	Flavonoid fraction	-	Muralidhar *et al.,* 2010
		Methanolic	200 and 400mg/kg (30min prior)	William *et al.*, 2007
		Butein	0.1 – 10 µM	Lau *et al.,* 2010
Antioxidant and free radical scavenging activity	Flowers	Ethyl acetate, butanol and aqueous fractions	10-100 µg/ml	Lavhale *et al.*, 2007
	Leaf	Aqueous and ethanolic extract	200 – 400 mg/kg× 7 days	Singh *et al*., 2015a
Anti-cancer	Flowers	Aqueous extract	0.1, 0.3 and 1mg/ml	Choedon *et al.*, 2010
		Methanolic extract	100 and 200 mg/kg	Sehrawat *et al.,* 2006
		n-butanol fraction	10 -1000 µg/ ml	Ganeshan *et al.*, 2015
Hepatoprotective effect	Flowers	Aqueous extract	200, 400 and 800 mg/kg, p.o.	Sharma *et al.,* 2011
	Bark	Methanolic extract	200 mg/kg and 400 mg/kg, p.o× 10 days	Sathish *et al.,* 2011
		Hydroalcholic extract	100 and 200 mg/kg dose × 3 days	Tiwari *et al.,* 2011
Nephroprotective	Flowers	Ethanolic extract	200, 400 mg/kg × 14 days	Sonkar *et al.*, 2014
		n-butanolic fraction	100, 200 mg/kg × 28 days	Sutariya *et al.,* 2015
Anti-asthmatic	Flowers	n-butanolic fraction	50,100 and 200 mg/kg i.p × 4 days	Shirole *et al.*, 2013
Anti-anthelmintic	Leaves	Alcohol and ethyl acetate extracts	25, 50 and 100 mg/mL	Borkar *et al*., 2010
	Seeds	Methanol extract	600, 800, 1000 and 1200 µg/ml	Prashanth *et al.*, 2001
		Crud powder	1, 2 and 3 g/kg × 1 day	Iqbal *et al.*, 2006
		Aqueous extracts	100 mg/ml × 6 h	Singh *et al.,* 2015b
Anticonvulsant activity	Flowers	Acetone-soluble	50 and 100 mg/kg i.p.	Kasture *et al*., 2000
		Triterpene	10–100 mg/kg, i.p.	Kasture *et al*., 2002
	Lark and Leaf	Ethanolic extract	250 and 500 mg/kg i.p.	Sangale *et al.*, 2015
Anti-diarrhoeal	Bark	Ethanolic extract	200, 400 and 800 mg/kg	Gunakkunru *et al.,* 2005
Wound healing	Bark	Flavonoid fraction	25 and 50 mg/kg	Muralidhar *et al.,* 2013
		Alcoholic extract	-	Sumitra *et al*., 2005
		Ethanol and aqueous extracts	-	Gavimath *et al.*, 2009
Anti-filarial	Leave and Roots	Aqueous extract	20-100ng/ml for 24hrs	Sahare *et al*., 2012
	Leaves	Methanol and hexane–ethanol extract	0.25 to 10.0 mg/mL	Deshmukh et al., 2014
Anti-ulcer	Bark	Methanol extract	100, 250 and 500 mg/kg	Patil *et al.,* 2008
	Bark	-	100, 250 and 500 mg/kg	Mhatre *et al*., 2014
Anti-stress	Flowers	Ethanolic extract	(100, 200 or 400 mg/kg)	Bhatwadekar et al., 1999
Anti-dopanergic	Flowers	Isoflavone	50 and 100 mg/kg	Velis *et al.*, 2008
Osteogenic activity	Bark	Medicarpin, cajanin, formonentin, isoformonentin	-	Maurya *et al*., 2009
	Bark	Cajanin	10 mg/kg × 30 days	Bhargavan *et al.,* 2009
Contraceptive	Seeds	Butin	5, 10 and 20 mg/kg	Bhargava, 1986
Sunscreen activity	Seed	Powder	2g/kg, p.o. × 3 days	Gupta *et al.,* 2010
	Leaves	-	0.5, 1 and 1.5%	More *et al.,* 2013

The hydroalcoholic extract of *Butea monosperma* flowers and butrin, isobutrin enriched fraction were able to decrease the secretion of pro-inflammatory cytokines, matrix metalloproteinase and prostaglandin production (Krolikiewicz-Renimel *et al.,* 2013). Similarly, flavonoids rich fraction of *Butea monosperma* stem bark possesses anti-inflammatory activity by modulating cyclooxygenase and lipoxygenase enzymes and augmenting antioxidant defence system in the inflammation bearing rat (Muralidhar *et al.,* 2010). The methanolic extract of *Butea monosperma* flowers inhibited the carrageenan induced paw edema and cotton pellet induced granuloma formation (Shahavi *et al.,* 2008). Similarly, the methanolic extract of *Butea monosperma* stem bark exhibited anti-inflammatory activity in a dose dependant manner on carrageenan induced paw (William *et al.,* 2007). The butrin, isobutrin, and butein isolated from *Butea monosperma* flowers significantly reduced the phorbol 12- myristate 13-acetate (PMA) and calcium ionophore A23187-induced inflammatory gene expression and production of TNF-α, IL-6, and IL-8 in Human Mast Cells by inhibiting the activation of NF-kB (Rasheed *et al.,* 2010). Similarly, butein isolated from *Butea monosperma* flowers significantly inhibited PMA -induced COX-2 expression in the non-tumorigenic MCF-10A and cancerous MCF-7 breast cells by inhibiting ERK and p-MAPK followed by inhibition in total activity of PKC (Lau *et al.,* 2010).

Antioxidant and free radical scavenging activity

The ethyl acetate, butanol and aqueous fractions from total methanolic extract of *Butea monosperma* flowers possess free radical scavenging activity (Lavhale *et al.,* 2007). The aqueous and ethanolic leaf extracts of *Butea monosperma* do contain compounds capable of inhibiting the cyclophosphamide induced oxidative stress and subsequent DNA damage in both the peripheral blood and bone marrow cells in mice (Singh *et al.,* 2015a).

Anti-cancer

The aqueous extract of *Butea monosperma* flowers inhibited cell proliferation and accumulation of hepatoma cell in G1 phase with significance induction of apoptotic cell death suggesting chemopreventive and anti-cancer property (Choedon *et al.,* 2010). Similarly, the pre-treatment of methanolic extract of *Butea monosperma* have chemopreventive effects on 2-acetylaminofluorine induce hepatic carcinogenesis (Sehrawat *et al.,* 2006). *In vitro* and *In silico* docking data suggested that the n-butanol fraction of *Butea monosperma* floral extracts potential anticancer activity (Ganeshan *et al.,* 2015).

Hepatoprotective effect

The aqueous extract of *Butea monosperma* flowers restored serum transaminases, hepatic lipid peroxidation, reduced glutathione and total protein levels against CCl_4 induced acute liver injury (Sharma *et al.,* 2011). The methanolic extract of stem bark of *Butea monosperma* also showed significant hepatoprotective effect CCl_4 induced acute liver injury (Sathish *et al.,* 2011). The hydroalcholic extract of the stem bark of Butea monosperma have significant hepatoprotective effect CCl_4 induced toxicity (Tiwari *et al.,* 2011).

Nephroprotective

Ethanolic extract of *Butea monosperma* significantly inhibited the levels of serum creatinine, serum urea and blood urea nitrogen in gentamicin induced nephrotoxicity (Sonkar *et al.,* 2014). The n-butanolic fraction of *Butea monosperma* flowers significantly reduced proteinuria, hypoalbuminemia, dyslipidemia and restored renal antioxidant enzyme activities in doxorubicin induced nephrotic syndrome (Sutariya *et al.,* 2015).

Anti-asthmatic

n-butanolic fraction of *Butea monosperma* inhibited the lipopolysaccharide induced increase in total cell count, nitrate-nitrite, total protein and albumin levels in bronchoalveolar fluids in rats (Shirole *et al.,* 2013).

Anti-anthelmintic

The alcoholic and ethyl acetate extracts of *Butea monosperma* leaves exhibited significant in vitro anthelmintic activity against earth worms, roundworm and tapeworms (Borkar *et al.,* 2010). The methanolic extract of *Butea monosperma* seeds exhibited significant in vitro anthelmintic activity against *Caenorhabditis elegan* (zwild strain, N2 type) (Prashanth *et al.,* 2001). The crude powder of *Butea monosperma* seeds exhibited significant *in vitro* anthelmintic activity in sheep naturally infected with mixed species of gastrointestinal Trichostrongylid nematodes (Iqbal *et al.,* 2006). The aqueous extracts of *Butea monosperma* seeds exhibited anthelmintic efficacy against Haemonchus contortus of sheep and goats (Singh *et al.,* 2015b).

Anti-convulsive

The acetone-soluble part of the petroleum ether extract of *Butea monosperma* flowers exhibited anticonvulsant activity (Kasture *et al.,* 2000). Further studies revealed that the triterpenes isolated from the n-hexane:ethyl acetate fraction of *Butea monosperma* flowers have anticonvulsant activity in pentylenetetrazol induced seizures (Kasture *et al.,* 2002). The ethanolic extract of *Butea monosperma* bark and leaf exhibited anticonvulsant effect in pentylene tetrazole and maximal electro shock seizure models (Sangale *et al.,* 2015).

Anti-diarrhoeal

The ethanolic extract of stem bark of *Butea monosperma* inhibited castor oil induced diarrhoea and PGE_2 induced enterpooling in rats. it also reduced gastrointestinal motility after charcoal meal administration (Gunakkunru *et al.,* 2005).

Wound healing

The ethanol and aqueous extracts of *Butea monosperma* stem bark possess wound-healing properties in experimental animals (Gavimath *et al.,* 2009). The flavonoid fraction of *Butea*

monosperma stem bark showed wound healing property. (Muralidhar *et al.,* 2013).

The ethanolic extract and the acetone fraction of *Butea monosperma* stem bark showed the significant wound healing activity which was evident by the increased rate of wound contraction, reduction in the period of epithelialisation and increase in collagen deposition (Muralidhar *et al.,* 2011). The alcoholic bark extract of *Butea monosperma* accelerated wound healing action by increasing cellular proliferation and collagen synthesis at the wound site, as evidenced by increase in DNA, total protein and total collagen content of granulation tissues (Sumitra *et al.,* 2005)

Anti-filarial

The aqueous extract of *Butea monosperma* leave and roots showed significant inhibition of motility of brugia malayi microfilariae as compare to control suggesting anti-filarial effects (Sahare *et al.,* 2012). The methanolic and hexane-ethanolic extracts of *Butea monosperma* plant leaves showed significant antifilarial activity in terms of motility inhibition assay and MTT-reduction assay (Deshmukh *et al.,* 2014).

Anti-microbial

The hydro-alcoholic flower extract of *Butea monosperma* has shown antibacterial activity against pathogenic bacteria viz., Escherichia coli (Sharma *et al.,* 2013). Similarly, the leaf-extracts of *Butea monosperma* with hot water and ethanol has shown significant antibacterial activity against all bacteria (Sahu *et al.,* 2013). The various bioactive flavonoids like dihydrochalcone and dihydromonospermoside from *Butea monosperma* flowers along with butein, monospermoside and isoliquiritigenin have shown anti-mycobacterial activity (Chokchaisiri *et al.,* 2009). The ethanolic extract of dried flowers and seeds of *Butea monosperma* have strong antimicrobial activity against standard cultures of *Escherichia coli, Pseudomonas aeruginosa, Shigella flexneri, Salmonella typhi, and Salmonella paratyphi* (Tambekar *et al.,* 2010). The hexane: ethanol combination extract has shown antimicrobial activity against multidrug resistant bacteria including *staphylococcus aureus, Bacillus cereus, Pseudomonas aeruginosa* and *Escherichia coli* (Lohitha *et al.,* 2010).

Anti-ulcer

The methanolic extract showed significant recovery against aspirin and ethanol induced gastric ulcerations suggesting anti-ulcer and anti-secretary potential. The stem bark of *Butea monosperma* markedly inhibited the acid output, the number of lesion along with reduction in volume of gastric juice, reflecting a positive effect of *Butea monosperma* on indomethacin induced gastric ulcers (Mhatre *et al.,* 2014)

Anti-stress

The water soluble part of ethanolic extract of *Butea monosperma* attenuated water immersion stress induced elevation of brain serotonin and plasma corticosterone level comparable to diazepam (Bhatwadekar *et al.,* 1999).

Anti-dopanergic

The isoflavone isolated from methanolic extract of flowers of *Butea monosperma* has antidopaminergic activity. They found that the antidopaminergic activity is present in the ethyl acetate fraction isolated from methanolic extract of *Butea monosperma* flowers (Velis *et al.,* 2008).

Osteogenic activity

The medicarpin, cajanin, formonentin, isoformonentin and cladrin isolated from stem bark of *Butea monosperma* have shown promicing osteogenic activity (Maurya *et al.,* 2009). Similarly, Cajanin from *Butea monosperma* bark increased bone mineral density at all skeletal sites studied, bone biomechanical strength, mineral apposition rate (MAR) and bone formation rate (BFR), compared with control. (Bhargavan *et al.,* 2009).

Contraceptive

Butin isolated from the seeds of *Butea monosperma* possesses postcoital anti-implantation and anti-conceptive activity in the pregnant rats during the implantation period. (Bhargava, 1986). Similarly, the administration of *Butea monosperma* seed powder caused disintegration of ova in the ovaries. Most of the follicle in immature state with undefined nucleus and nucleoli in the ovum (Gupta *et al.,* 2010).

Sunscreen activity

The formulated cream containing the leaves extract of *Butea monosperma* has potency to protect against UVA and UVB rays indicating sunscreen activity as well the formulations produced by incorporating different concentration of extracts can be applicable for different type of Skin respectively as per SPF (Sun Protection Factor) value (More *et al.,* 2013).

Protease inhibitor activity

The protease inhibitor isolated from the seeds of *Butea monosperma* (BmPI) possesses measurable inhibitory activity on total gut proteolytic enzymes of *Helicoverpa armiger*a and bovine trypsin. These detrimental effects on *Helicoverpa armiger*a suggest the usefulness of BmPI in insect pest management of food crops (Pandey *et al.,* 2014).

CONCLUSION

The present review shows the pharmacological, traditional and phytochemical activities of *Butea monosperma*. The plant *Butea monosperma* has an excellent potential against various ailments and have been experimentally and clinically utilized in both animals and man. Further relevant studies are necessary to determine the mechanism by which *Butea monosperma* exhibit medicinal potential and these effects need to be confirmed using clinical trials for its effective utilization as therapeutic agents.

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