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## THERAPEUTIC SIGNIFICANCE OF *Butea monosperma*: A REVIEW

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### ABSTRACT

*Butea monosperma* (Palas) belonging to the family leguminaceae grown wildly in many parts of India. This herb is indigenous to India. The tree is found chiefly in the mixed or dry deciduous forests of Central and Western India. The plant is highly used by the rural and tribal people in curing various disorders. Flowers are used as drug in many ailments like eye disease, chronic fever, enlargement of spleen, leucorrhoea, epilepsy, leprosy, Antifungal activity, Anti-inflammatory activity, Liver disorders antifertility activity and gout etc. The plant parts are used in the form of extract, juice, infusion, powder and gum. The present paper enumerates various pharmacognostic and pharmacological aspects of the plant. This review also summarizes the therapeutic potential of this plant.

Keywords: *Butea monosperma*, palas, medicinal uses, Therapeutic, Pharmacological aspects

### INTRODUCTION

*Butea monosperma* (Palas), is a medium-sized deciduous tree belongs to family Leguminosae-Papilionaceae. This tree is also called 'Flame of the Forest' and Bastard Teak. It grows throughout the Indian subcontinent, especially in Indo-Gangetic plains. It is said that the tree is a form of Agnidev, God of Fire. It was a punishment given to Him by Goddess Parvati for disturbing her and Lord Shiva's privacy. This tree gets up to 50 ft high, with stunning flower clusters. It loses its leaves as the flowers develop, January - March. The trunk becomes twisted and gnarled by the wind, making it a conversation piece. Use it as a specimen, or as a background component of the canopy.

These are also used as cheap leaf plates and cups for rural feasts. In some parts of the country these are used for wrapping tobacco to make biddies. These are further used as packing material for parcels. The cattle also eat the palas foliage quite eagerly. The bark yields a kind of coarse and brown colored fiber, which is used for rough cordage. *Butea* gum is a dried astringent juice obtained from incisions in the stem of the tree. The juice exuded by the bark hardens into brittle ruby colored gum beads. This gum is sanctioned to be used as a substitute for the kino gum. It finds use for caulking boats as well. The flowers yield an orange dye. A preparation of the same is used as an insecticide. The tree acts as a host for lac insect and is, therefore, useful in producing natural lac.<sup>1,2</sup> It is a sacred tree, referred to as a treasurer of the gods, and used in sacrifice related rituals. From its wood, sacred utensils are made. The flowers are offered as in place of blood in sacrifice rituals to goddess Kali. The dry stem pieces are used to make sacred fire. It is an anthropogenic tree of several castes. 'Chakradatta' mentions the use of its gum in external astringent application. The leaves are believed to have astringent, depurative, diuretic and aphrodisiac properties. It promotes diuresis and menstrual flow. The seed is anthelmintic. When seeds are pounded with lemon juice and applied to the skin the act as a rubefacient.<sup>3,4</sup>

### Other Name:

- **English :** Flame of the forest, Bastard teak, Bastard Teak, Parrot Tree
- **Hindi :** Dhak, Palas, Chichra tesu, desukajhad, dhak, chalcha, kankrei
- **Kannada :** Muttagamara,
- **Malayalam :** Plasu Camata, Muriku, Shamata
- **Sanskrit :** Palasah
- **Tamil :** Porasum, Parasu, Camata
- **Telugu :** Modugu
- **Gujrat:** Khakda
- **Bangal:** Palas, Polashi
- **Urdu:** Palashpapra

### BOTANICAL CLASSIFICATION

<b>Kingdom</b>	:	Plantae
<b>Division</b>	:	Magnoliophyta
<b>Class</b>	:	Magnoliopsida
<b>Order</b>	:	Fabales
<b>Family</b>	:	Fabaceae
<b>Genus</b>	:	Butea
<b>Species</b>	:	Monosperma

### MORPHOLOGY

It is an erect, medium sized tree of 12-15 m high, with a crooked trunk and irregular branches. The shoots are clothed with gray or brown silky pubescence. The bark is ash coloured. The leaves 3 foliate, large and stipulate. Petiole is 10-15 cm long. Leaflets are obtuse, glabrous above, finely silky and conspicuously reticulately veined

beneath with cunnate or deltoid base. From January to March the plant is bald. Flowers in rigid racemes of 15 cm long, densely brown velvety on bare branches. Calyx is dark, olive green to brown in colour and densely velvety outside. The corolla is long with silky silvery hairs outside and bright orange red. Stamens are diadelphous, anthers uniform. Ovary has 2 ovule, style filiform, curved and stigma capitate. Pods argenteocanescent, narrowed, thickened at the sutures, splitting round the single apical seed, lowest part indehiscent. The seeds are flat, reniform, curved. The bole is twisted and gnarled and the branching too follows no particular pattern. It is slow growing and



**Figure 1: Stem and leaves of *Butea monosperma***

When the tree is leafless, it bears flaming orange to red-colored flower. These flowers start appearing in February and stay on nearly up to the end of April. The size is nearly 2 to 4 cm in diameter. The calyx i.e. the lower whorl of the flower tends to be darkish gray like the supporting branch itself. The upper parts are brick red. These give the plant

attains a height of about 5 to 8 m and diameter of about 20 to 40 cm when mature at the age of about 50 years or so. The bark of palas is fibrous and bluish gray to light brown in color. It exudes a kind of red juice when injured.

The leaves are compound. Each has three leaflets. The texture of the leaflets is fairly tough. These are coriaceous with the surface glabrescent above and hairy silken beneath. The size varies from 15 cm to 20 cm by 10 cm x 15 cm. The shape is obliquely ovate and broadly elliptic. The leaves fall off by December and reappear during spring.



**Figure 2: Flowers of *Butea monosperma***

The fruit of palas is a flat legume; a pod, nearly 15 cm long and 3 to 5 cm wide. Young pods have a lot of hair a velvety cover. The mature pods hang down like peculiar legumes.

The seeds are flat, from 25 to 40 mm long, 15 to 25 mm wide, and 1.5 to 2 mm thick. The seed-coat is reddish-brown in color, glossy, and wrinkled, and encloses two large, leafy, yellowish cotyledons. The hilum is conspicuous, and situated near the middle of the concave edge of the seed.

so handsome a look despite it is leafless during spring season when entire terrain having palas trees wears a kind of exquisite orange and red hue. The flowers form a gorgeous canopy on the upper portion of the tree, giving the appearance of a flame from a distance

The odor is faint, and the taste slightly acrid and bitter. The wood is greenish white in color. It is porous and soft in texture and has annual rings though not very distinct. It generally perishes fast when used at sites open to vagaries of weather, but lasts much longer when used under water. It is therefore used for making well curbs and piles<sup>5-10</sup>.

## CHEMICAL CONSTITUENTS

**Flower** - Triterpene<sup>11</sup>, several flavonoids butein, butin, isobutrin, coreopsin, isocoreopsin (butein 7-glucoside), sulphurein, monospermoside(butein 3-e-D-glucoside) and

isomonospermoside, chalcones, aurones, isobutyine, palasitrin, 3',4',7- trihydroxyflavone<sup>12</sup>. Myricyl alcohol, stearic, palmitic, arachidic and lignoceric acids<sup>13</sup> glucose, fructose, histidine, aspartic acid, alanine and phenylalanine<sup>14</sup> Gum -Tannins, mucilaginous material, pyrocatechin<sup>9</sup>.

**Seed** - Oil (yellow, tasteless), proteolytic and lypolytic enzymes, plant proteinase and polypeptidase<sup>10</sup>. A nitrogenous acidic compound, along with palasonin is present in seeds. It also contains monospermoside (butein3-e-D-glucoside) and somonospermoside<sup>12</sup>. Allophanic acid, several flavonoids (5, 6, 7, 4'-tetrahydroxy-8-methoxyisoflavone 6-O-rhamnopyranoside<sup>15</sup> Butin<sup>37</sup>  $\alpha$ -Amyrin,  $\beta$ - sitosterol,  $\beta$ -sitosterol- $\beta$ -D-glucoside, sucrose<sup>16</sup>, Fatty acids such as myristic, palmitic, stearic, arachidic, behenic, lignoceric, oleic, linoleic and linolenic<sup>16</sup> Monospermin<sup>17</sup>. And an acid imide<sup>18</sup> 15- Hydroxypentacosanoic acid nhenicosanoic acid  $\delta$ -lactone<sup>19</sup>, 10, 16-dihydroxyhexadecanoic acid<sup>20</sup>, Phosphatidylcholine, phosphatidyl ethanolamine and phosphatidylinositol<sup>21</sup>.

**Root** - The root of *Butea monosperma* contains glucose, glycine, a glycoside (aglycon) and an aromatic hydroxy compound<sup>22</sup>

**Stem** - 3-Z-hydroxyeuph-25-ene and 2,14-dihydroxy-11,12-dimethyl-8-oxo-octadec-11-enylcyclohexan<sup>23</sup> Stigmasterol-e-D-glucopyranoside and nonacosanoic acid<sup>24</sup> Flavonoid 8-C-prenylquercetin 7,4'-di- O-methyl-3-O- $\alpha$ -L-rhamnopyranosyl(1-4)- $\alpha$ -L-rhamnopyranoside<sup>25</sup> 3-hydroxy-9~ methoxypterocarpan [(-)-medicarpin]. Lupenone, lupeol, sitosterol, 5-methoxygenistein and prunetin<sup>26</sup>. 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-oxo octacosanoic acid Me ester, 4-pentacosanylphenol and pentacosanyl- $\beta$ -D-glucopyranoside<sup>27</sup>.

**Bark** - Kino-tannic acid, Gallic acid, pyrocatechin<sup>28</sup>. Also contains palasitrin, and major glycosides as butrin, alanind, allophanic acid, butolic acid, cyanidin, histidine, lupenone, lupeol, (-)-medicarpin, miroestrol, palasimide and shellolic acid<sup>16-18, 28, 29</sup>. Two compounds, 3, 9-dimethoxypterocarpan, and triterpenoid ester, 3 $\alpha$ -hydroxyeuph-25-enyl heptacosanoate<sup>27</sup>.

**Leaves** - Glucoside, Kino-oil containing oleic and linoleic acid, palmitic and lignoceric acid<sup>13</sup>.

**Resin** - Jalaric esters I, II and laccijalaric esters III, IV.; Z-amyrin, e-sitosterone and its glucoside ,sucrose, lactone-nheneicosanoic acid-{-lactone<sup>30,31</sup> Sap - Chalcones, butein, butin, colourless isomeric flavanone and its glucosides, butrin<sup>9</sup>.

## PHARMACOLOGY AND MEDICINAL USES

According to ayurveda it contains:

- Gunna (properties) –laghu (light), ruksh (dry)
- Rasa (taste) – kashaya (astringent), tickt (bitter) and katu (pungent)
- Virya (potency) – ushan (hot)

It has following 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<sup>26</sup>. The seed oil of *Butea monosperma* shows significant bactericidal and fungicidal effect in in-vitro testing<sup>17</sup>

### **Anti-inflammatory activity**

The leaves of *Butea monosperma* exhibit ocular anti-inflammatory activity in rabbits. 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%<sup>32</sup>.

### **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<sup>33</sup>. 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<sup>34</sup>.

### **Anticonvulsive activity**

It shows anticonvulsive activity, due to the presence of a triterpene<sup>35</sup>. The ethanolic extracts of leaves of *Albizzia lebbeck* and flowers of *Hibiscus rosa sinesis* 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<sup>36</sup>.

### **Antiestrogenic and antifertility activity**

Alcoholic extract of flowers of *Butea monosperma* has also been reported to exhibit antiestrogenic<sup>37</sup>. 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<sup>38</sup>. Butin also exhibits male contraceptive properties<sup>39</sup>. Antifertility effect of seed extract of *Butea frondosa* has also been reported in mice. The stem bark of *Butea monosperma*, led to the isolation and identification of three new compounds named buteaspermin A, buteaspermin B and buteaspermanol, along with 19 known compounds<sup>40</sup>.

### **Hemagglutinating activity**

Seeds of *Butea monosperma* showing specificity towards human erythrocytes<sup>41</sup>. The lectins such as Butea

monosperma agglutinin (BMA) isolated from the seeds of *Butea monosperma* are responsible for agglutinating property<sup>42</sup> 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<sup>43</sup>.

#### **Antidiabetic activity**

The leaves of this *Butea* tree can either be chewed or taken in decoction or infusion form. 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<sup>44</sup>. 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<sup>45</sup>.

#### **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<sup>46</sup>.

#### **Diarrhoea**

*Butea monosperma* gum has also been found useful in cases of chronic diarrhoea. It is a powerful astringent and also decreases bilirubin level. 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<sup>44</sup>.

#### **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<sup>47</sup>. Flowers of this plant are also effective in leprosy, leucorrhoea and gout<sup>10</sup>.

#### **Anthelmintic activity**

The seeds of the plant are used in Ayurvedic system as an anthelmintic drug<sup>48</sup>. 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*<sup>49</sup>.

#### **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<sup>50</sup>.

#### **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<sub>3</sub>), thyroxin (T<sub>4</sub>) 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<sup>51</sup>.

#### **CONCLUSION**

Herbs are the natural drugs used to regain the alterations made in normal physiological system by foreign organisms or by any malfunctioning of the body. In every ethnic group there exists a traditional health care system, which is culturally patterned. In rural communities, health care seems to be the first and foremost line of defense. The WHO has already recognized the contribution of traditional health care in tribal communities. It is very essential to have a proper documentation of medicinal plants and to know their potential for the improvement of health and hygiene through an eco friendly system. Thus importance should be given to the potentiality of ethnomedicinal studies as these can provide a very effective strategy for the discovery of useful medicinally active identity. A detailed and systematic study is required for identification, cataloguing and documentation of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plants. The present review reveals that the plant *Butea monosperma* is used in treating various ailments. It elicits on all the aspects of the herb and throws the attention to set the mind of the researchers to carry out the work for developing its various formulations, which can ultimately be beneficial for the human beings as well as animals.

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