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BUTEA MONOSPERMA: ETHANOMEDICINAL STUDIES AND PHARMACOLOGY: A REVIEW

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ABSTRACT

Butea monosperma (Lam.) Taub (Syn Butea frondosa Family Fabaceae), also known as "palas" and "Flame of forest," is one of several natural crude medications used in traditional medicine that have the ability to treat a variety of diseases and ailments[1]. Butea monosperma is a tropical and subtropical climate tree that grows gregariously in woods, open grasslands, and wastelands in India's drier regions. It thrives in a broad range of soil types, including saline or wet soils, clay loams, shallow, gravelly locations, and black cotton soil. It is an upright, 12- to 15-meter-tall tree with a crooked trunk and uneven branches. Butea monosperma comes in a number of species all over the world. 3 foliate, big, and pointed leaves are present. Many components from Butea species, including amides, lactones, flavonoids, sterols, and alkaloids, have been identified. For products like feed, fuel, fibers, timber, gum or resin, dyestuff, and historically for a number of ailments, Butea monosperma is recognized as a trustworthy source. Pharmacologically, Butea monosperma has been linked to a number of effects, including anthelmintic, anticonvulsant, and anticonceptive[4]. anti-diabetic, anti-diarrheal, anti-estrogenic, anti-fertility, anti-inflammatory, anti-microbial, anti-fungal, anti-bacterial, anti-stress, chemopreventive, hemagglutinating, hepatoprotective, radical-scavenging, thyroid inhibitory, antiperoxidative, anti-hyperglycemic, and wound healing properties. The current review goes into great detail into the morphology, ethnobotany, phytochemical components, and traditional uses of each plant part, as well as the products made by the plant and the pharmacological functions of each plant part [7].

Keyword: Butea monosperma, ethnobotany, ethnomedicinal, pharmacology.

1. INTRODUCTION

It is obvious that human life is impossible without nature. Humans' three primary needs are for food, clothing, and shelter, and today the fourth is for good health, which is provided by the plant kingdom.[1] Nature stands out as a shining example and offers a wealth of treatments for all human ills. The plant world is an abundant source of organic chemicals, many of which have been used medicinally and may one day lead to the creation of novel drugs that are effective against a variety of pathological conditions. In India, herbs have long been the primary form of medicine, and today they are gaining popularity around the globe as people try to stay healthy in the face of ongoing stress and pollution and cure illness with drugs that support the body's natural defenses. Green medications are often thought to be safer, more effective, and healthier than artificial ones.[2]

Several natural, unprocessed medications are used in conventional medicine and have the ability to treat a wide range of illnesses and problems. One of these is Butea monosperma (Lam.) Taub (Syn. Butea frondosa Family Fabaceae), also known as palas, palash, mutthuga, bijasneha, khakhara, chichara, Bastard teak, and Bengal kino, and also known as the "Flame of Forest" and other other names.[2] The deciduous tree Butea monosperma (Palas) is a medium-sized tree. It expands throughout the Indian particularly in the Indo-Gangetic plains of the subcontinent. According to legend, the tree is a manifestation of the fire god Agnidev. Goddess Parvati punished him for invading her and Lord Shiva's private space [8]. This tree has magnificent flower clusters and can grow up to 50 feet tall. In January through March,

as the blossoms grow, it sheds its leaves. The wind twists and gnarls the tree, turning it into a talking point that is employed as a specimen or as a background element of the cover.[4] There are 35 species of butea found in India, for example like Butea affinis, Butea apoensis, Butea acuminate etc. [5]

2. BOTANICAL DESCRIPTION OF BUTEA MONOSPERMA

It is an upright, 12- to 15-meter-tall tree with a crooked trunk and uneven branches. Silky pubescence in shades of grey or brown covers the shoots. Ash-colored bark can be seen. The three foliate, big, and stipulate leaves. Petiole length is 10 to 15 cm.[5] The bases of the leaflets are cunnate or deltoid, and they are obtuse, glabrous above, delicately silky, and prominently reticulately veined beneath. The plant has bald patches from January through March. Flowers grow in 15 cm long, stiff racemes that are heavily covered in brown velvet. Calyx has a highly velvety exterior and is dark, olive green to brown in colour.[6] The corolla is lengthy and has bright orange red and silky silvery hairs on the outside. Anthers are uniform, while stamens are didelphis. The ovary has two ovules, a capitate stigma, and a filiform, curving style.[8] The lower half of the argenteocanesent, constricted, thicker at the sutures pods break around the single apical seed. The seeds are reniform, flat, and curled. Palas have fibrous bark that ranges in hue from bluish grey to light brown. When hurt, it releases a kind of scarlet juice.[6] Three leaflets make up each of the complex leaves. The leaflets have a coriaceous texture that is quite rough, with a surface that is glabrescent above and hairy silky below.[10] The dimensions range from 10 cm x 15 cm by 15 cm to 20 cm. The form is widely elliptic and obliquely oval. By December, the leaves are lost, and they come back in the spring.[11]

The tree produces flamboyant orange to red flowers when it is leafless . These blooms begin to bloom in February and continue for almost the entire month of April. The diameter is almost 2 to 4 cm. The lowest whorl of the flower, or the calyx, is often darkish grey in colour, much like the supporting branch. Brick red dominates the higher areas.[11] They give the plant a very attractive appearance even though it has no leaves in the spring, when the entire area covered with palas trees takes on a gorgeous orange and scarlet tint. On the tree's upper branch, the blossoms create a stunning canopy that resembles a flame.[12]

The palas plant produces a flat, 15 cm length by 3 to 5 cm wide pod-shaped fruit. Young pods have a velvety covering and a lot of hair. When ripe, the pods droop like strange legumes. The flat, 25 to 40 mm-long seeds are round. 1.5 to 2 mm thick and 15 to 25 mm in width.[13] The two large, leafy, yellowish cotyledons are enclosed by a reddish-brown, glossy, and wrinkled seed coat. Towards the centre of the seed's concave edge, the hilum is clearly visible.[18]

The colour of the wood is a greenish white. It contains annual rings, albeit they are not particularly prominent, and is porous and soft in texture. When utilised in locations subject to weather changes, it often deteriorates quickly; however, when used underwater, it lasts much longer. Thus, it is utilised to create effective curbs and piles.[15]

Butea monosperma is commonly known as khakhro in gujarati.In hindi it has several other synonyms such as dhak, palas, chichra tesu , desukajhad, chalcha and kankrei.In english it is known as bastard teak, parrot tree and flame of forest because of it’s bright saffron flowers. Pepole in Maharashtra generally call it palas and kakracha. The ancient texts of Sanskrit literature have mentioned the plant as palash, kuimsuka, brahma vrksha. Tesh is the punjabi term of Butea monosperma. In west Bengal terms such as Palash and polashi are used. Kodagu and Puvvu are the synonyms used for Butea monosperma in telugu. People of Assam use the same word Palash as being used in the ancient texts of sanskrit literature .kannada language has words such as Muttagamara and Muttulu used for Butea monosperma.[9]

3. PHYTOCHEMICAL CONSTITUENTS

Flower: Triterpene, Butin, Butein, isobutrin, isocoreopsin (butin 7-glucoside), coreopsin, sulpharein, monosprmoside (butein 3-e-D- glucoside), and isomonospermoside, chakiness’, aureoles, flavonoids (palasitrin, prunetin) and steroids [35].

Gum: Tannins, mucilaginous material, pyrocatechinic.[11]

Seed: Oil (yellow, tasteless), proteolytic and lipolytic enzyme, polypeptidase and plant proteinase. In addition to Panasonic, seeds contain a nitrogenous acidic substance. Additionally, it includes monospermous(butein 3-e-D-glucoside)[24]

Leaves: Glucoside, kino-oil containing linoleic acid, oleic, palmitic and lignoceric acid [35].

Stem:2,14-dihydroxy-11, 12-dimethyl-8-oxo-octadec-11-enylcyclohexane and 3-Z-hydroxyeuph-25-ene. Noneconomic acid and stigmasterol-D-glucopyranoside[21].

4. PHARMACOLOGICAL ACTIVITIES OF BUTEA MONOSPERMA

4.1 Leaves

4.1.1 Antidiabetic activity

Male rats were given alloxan to cause diabetes. The ethanolic extract of BM leaves when taken orally exhibited antidiabetic action[35]. BM extract substantially reduced blood glucose levels and increased antioxidant enzyme activity after 45 days of treatment at a dose of 300 mg/kg, indicating that BM leaves have potent antioxidant and hypoglycemic effects, aqueous extract also use to reduced sugar level in blood. [10,22,12]

4.1.2 Anti-filarial activity

Microfilariae motility was substantially reduced by aqueous BM extract. (Brugia malayi). The IC50 figure for this effect, which was dose-dependent, was 83 ng/ml [15,12,27].

4.1.3 Anti- inflammatory

The leaves of Butea mono-inflammatory action in rabbits. The anti-inflammatory properties of Butea monosperma's methanolic extract were assessed using carrageenin-induced paw edoema and cotton particle granuloma. By 26 and 35% and 22 and 28%, respectively, in cotten pellet granuloma, respectively, in carrageenin-induced pawedema at 600 and 800 mg/kg and granuloma tissue development, respectively [26,22,11].

4.2 Seeds

4.2.1 Hemagglutinating activity

Butea monosperma seeds displaying a preference for human erythrocytes. The agglutinating characteristic of seeds, which was only demonstrated by seeds and not by flowers, leaves, roots, or stems, is caused by lectins such as Butea monosperma agglutinin (BMA), which was isolated from the seeds of Butea monosperma. Agglutinins specific to human blood type A have been found in some N-acetyl galactosamine/galactose-binding lectins, including the lectins. The greatest agglutination inhibitor, according to a hem agglutination test, is N-acetyl galactosamine.[17,21,30].

4.2.2 Anti-conceptive activity

Reduced implantation sites and a dose-dependent termination of pregnancy were observed at reduced doses. The butin showed estrogenic activity in young female rats with ovariectomies at doses that were similar to anticonception doses, but it had no anti-estrogenic effects[15]. Because a substantial uterotrophic effect was noticed even at a dose that was 1/200th of the anticonception dose, butin is a weak oestrogen. According to reports, seed oil is used as a conventional genital toner and contraceptive [10,12].

4.2.3 Antihelmintic activity

Palasonin, a substance isolated from Butea monosperma seeds, has antihelmintic properties. A dose- and time-dependent anthelmintic impact was seen when seeds were given as crude powder at doses of 1, 2, and 3 g/kg to sheep that were spontaneously infected with a variety of gastrointestinal nematodes. After treatment with 3 g/kg, the greatest decrease in eggs per gramme of feces, of 78.4%, was observed on day 10. Standard anthelmintic levamisole (7.5 mg/kg) demonstrated a 99.1% decrease in eggs per gramme. Earthworms, toxocara canis, oxyurids, dipylidium caninum, Ascaridia galli, Ascaris lumbricoides, and taenia have all been reported to be susceptible to different Butea species. Butea monosperma seeds also demonstrated substantial in vitro anthelmintic activity[15,14,26].

4.2.4 Anti-hyperglycemic and Anti-hyperlipidemic

The ethanolic solution made from BM seeds has anti-hyperlipidemic, anti-diabetic, and anti-oxidative properties. In non-insulin dependent diabetic (NIDDM) rats, the ethanolic extract administered for four weeks had a notable antihyperglycemic impact and improved glucose tolerance [5,20].

4.2.5 Antimicrobial activity

In vitro testing of BM seed oil revealed substantial fungicidal and bactericidal effects that could be attributed to the presence of active ingredients like medicarpin [6,25,32].

4.2.6 Hormone balancing effect

Alcoholic BM extract has anti-implantation and anti-estrogenic properties. However, active substances like butine, which also has male contraceptive characteristics, are what cause the estrogenic activity. Additionally, BM seed methanolic preparations have uterine peroxidase and antifertility effects [21,22,25].

4.3 Flower

4.3.1 Anticancerous activity

The accumulation of cells in the G1 phase and the inhibition of cell proliferation with a substantial induction of apoptotic cell death in an aqueous extract of BM suggested anticancer characteristics of the substance[27].

4.3.2 Antimycobacterial activity

BM flowers contain bioactive flavonoids, including butein, isoliquiritigenin, monospermoside, dihydromonospermoside, and dihydrochalcone, which have antimycobacterial properties. Its antifungal activity against different fungi species was disclosed by the study [21,29,32,35].

4.3.3 Antimicrobial activity

Flavone 5,7-dihydroxy-3,6,4-trimethoxyxylopyranosyl (13 -7-O-L-O-α-L-arabinopyranosyl-(1→4)-O-β-D Galactopyranoside exhibited antibacterial properties. The antimicrobial ability of BM seed oil is against pathogenic bacteria and fungi. The oil is therefore fungicidal and antibacterial[6,14,26].

4.3.4 Antidopaminergic acitivity

Rats' foot shock-induced aggression was inhibited by an isoflavone-isolated methanolic extract of BM, and it potentiated haloperidol's ability to cause catalepsy in a dose-dependent way[12,28].

4.3.5 Hepatoprotective effect

The hepatoprotective effects of BM flower aqueous extract (200, 400, and 800 mg/kg, p.o.) against CCl4 (1.5 ml/kg i.p.)-induced hepatotoxicity were investigated. Cirrhosis and degeneration of the liver can both be brought on by CCl4. As a result, the administration of CCl4 had a substantial impact on several biochemical variables, including levels of albumin, protein, hepatic lipid peroxidation, reduced glutathione, and total protein. It was observed that BM had dose-dependently corrected all altered biochemical parameters, including histopathological changes[17].

4.3.6 Antitumor activity

Butea monosperma flower aqueous extract given intraperitoneally to X-15-myc onco mice demonstrated antitumorgenic activity by preserving liver architecture and nuclear morphology while also lowering serum VGEF levels. Anti-ribosomal protein S27a antibody immunohistochemical staining of liver sections revealed that this proliferation marker from the tumor tissue disappeared after therapy [10,14,16].

4.3.7 Antiestrogenic and antifertility activity

The uterotropic and uterine peroxidase activities of ovariectomized rats were affected by methanolic extracts of Butea monosperma, and the estrogenic/antiestrogenic potential of antifertility substances was assessed using a rat uterine peroxidase test. The titular plant's flower's alcohol extract has also been said to have antiestrogenic and antifertility properties. Its flower-derived butin exhibits both male and female reproductive effect [9,11,12].

4.3.8 Radical scavenging activity

Different in vitro models, such as the reducing power assay, the scavenging of 2,2 diphenyl-1-picrylhydrazyl (DPPH) radical, nitric oxide radical, superoxide anion radical, and hydroxyl radical, as well as the inhibition of erythrocyte hemolysis using 2,2′ azo-bis (amidinopropane) dihydrochloride, were used to assess the radical scavenging activities of eth (AAPH)[15]. The aqueous portion of the methanol extract was found to be devoid of any radical scavenging properties, while the ethyl acetate and butanol fractions all demonstrated significant free radical scavenging activity. The higher phenolic concentration of the extracts (16.1, 25.29, and 17.74% w/w in the methanol extract, ethyl acetate, and butanol fractions, respectively) may be the cause of the observed activity[13,19,23].

4.4 Bark

4.4.1 Anti-diarrhoeal activity

Inhibiting gastrointestinal motility and PGE2-induced enteropooling are two ways that Butea monosperma stem bark ethanol extract inhibited castor oil-induced diarrhoea in Wistar albino rats. Following the administration of a charcoal meal, it also decreased gastrointestinal motility. In instances of chronic diarrhea, Butea monosperma gum has also been found to be beneficial. It has strong numbing properties and lowers bilirubin levels [8,12,16].

4.4.2 Wound healing activity

Rats' cutaneous lesion healing following topical application of a Butea monosperma alcoholic bark extract Increased granulation tissue DNA, total protein, and total collagen content led to increased cellular proliferation and collagen synthesis at the wound site, as well as a substantial rise in tensile strength and favourable results from histopathological examinations. Consequently, it has antioxidant qualities because it can lessen lipid peroxidation [14,19].

4.4.3 Anti-stress

An anti-stress impact was seen in the ethanolic extract of BM that was water soluble. The BM ethanolic extract has an anti-stress effect that is similar to diazepam by lowering the elevated levels of brain serotonin and plasma corticosterone [28].

4.4.4 Anti-fungal

In comparison to the common fungicide Benlate, Medicarpin had more antifungal action against Cladosporium cladosporioides. [8, 25,31]

4.4.5 Anti-ulcer

The anti-ulcer effects of BM bark's methanolic extract at 500 mg/kg were 79.30 and 82.20% healing against ethanol and aspirin-induced gastric ulcerations, respectively. This indicates that the extract has free radical scavenging characteristics. [6,27]

4.4.6 Anti-inflammatory

Similar to diclofenac sodium in a dose-dependent way, the methanolic extract of the stem bark of BM demonstrated analgesic and anti-inflammatory action against acetic acid-induced writhing, the hot plate test model, and carrageenan-induced paw edoema [10].

5. ETHNOMEDICINAL USES OF BUTEA MONOSPERMA

5.1 Flowers

Flowers are used to treat "Kapha," leprosy, gout, strangury, skin conditions, thirst, and sensation. Flower juice is helpful for eye conditions. The flower is aphrodisiac, expectorant, tonic, emmenagogue, diuretic, bitter, helpful for biliousness, inflammation, and gonorrhoea, and it is also bitter. The dye aids in spleen expansion.[15] Flowers are depurative; they are applied as a poultice to reduce edema and encourage menstrual flow. Moreover, it helps male urinogenital tracts from developing pus. If three to four spoons are consumed each day for a month to combat chronic fever and body heat, flowers are crushed in milk with sugar added. To treat leucorrhea, flowers are soaked in water over night and then a cup of the resulting infusion is consumed each morning [11]

5.2 Seeds

Children take powdered seeds as a preventative measure for intestinal worms. To cure urinal issues and prevent urinary stones, seeds are crushed in milk and eaten orally in a dose of around two spoons. According to Ayurveda, fruit and seeds are provided for scorpion stings because they are easily digestible, aperient, and cure "Vata" and "Kapha," skin ailments, tumours, and gastrointestinal problems. Fruit and seeds are helpful for inflammation, eye conditions, and piles. They are effective rubefacients when applied after being pounded with lemon juice and have been used to successfully treat a kind of herpes. referred to as Dhobie's itch.[10]

5.3 Gums

For fissures on the sole of the foot, gum is used. For dysentery, two spoons of diluted gum are recommended daily till recovery. Gum is beneficial for stomatitis, cough, pterygium, ocular opacities, and it can treat excessive sweating.[15]

5.4 Roots

The root is helpful in treating elephantiasis and lowers visual abnormalities while curing night blindness. root parts.[12] are heated, and the resulting extract is then suggested as a nighttime treatment for impotence. This treatment is given for a month. A spoonful of root powder diluted with water is consumed as a snake bite.[17]

5.5 Leaves

For eye illness, leaves are helpful. Leaf is a tonic, aphrodisiac, anthelmintic, astringent, carminative, appetizer, and it treats boils and piles in addition to lumbago and inflammation. To treat cough, cold, and stomach issues, the petiole is chewed, and the juice is sucked. For a month, leaf powder combined with a cup of water is consumed to treat diabetes.[13] When you have a sore throat, you can gargle with leaf extract. For two to three months, drink three to four spoons of leaf extract at night to check for abnormal menstrual bleeding.[20]

5.6 Stem Bark

Stem bark powder is applied on axe-related wounds. Human goiters are treated using stem juice. In cases of bodily swellings, stem hark paste is applied. Theanus, dysentery, piles, hydrocele, ulcers, and tumors can all be treated with bark, which is also aphrodisiac, bitter, appetizer, laxative, and anthelmintic. In addition to purifying the blood, bark is helpful for biliousness, dysmenorrhea, liver disorders, and gonorrhea. In the event of a scorpion sting, the ash of a young branch is administered in conjunction with other medications.[17] This medication has been extensively used in the treatment of several conditions in Ayurvedic literature Worm infestations, also known as Krimi Roga, can be treated either on its own or with several prepared medications. It is a key ingredient in several essential and popular Ayurveda medicine formulas used to treat Krimi Roga. This medication is mentioned in the Sushruta Samhita under four different categories of herbal remedies, including Rudaradigana, Musakadigana, Amabasatadigana, and Nyagrodhabigana, which treat a variety of disorders, including Medoroga, Striroga, and Pramcha. It is also said to have Kapha and Pittanasak properties. Its effectiveness in Netraroga and its astringent impact in various circumstances have also been discussed by ayurvedic authors. In a clinical study on worm infestations, the plant was found to be successful in cases of round worm and thread worm infestations, while the medicine was useless in the one and only instance of tape worm infestation.[20]

6. MISCELLANEOUS TRADITIONAL USES OF BUTEA MONOSPERMA:

Dye: To make a dye, Flowers are cooked and boiled in water.[12]
Fodder: Green leaves used as fodder for domestic animals.[9]
Fiber: Cordage is made from bark fibers of butea monosperma.[15]
Protection: Gonda which is obtain from leaves is used to protect from rain.[22]
Fuel: Moderate quality of fuel is obtained from wood of Butea monosperma, sometimes leaves are also used as fuel.[21]
Timber: The non-durable wood of timber obtain from Butea monosperma is light, white or yellowish brown when fresh.[21]
Vegetables: Tribals are used young fruits and flower as vegetables.[15]
Festival: On occasion of Pola festival fresh twigs are tied on horns of bullocks.[22]
Domestic utensil: Dinning plates and bowls are made from fresh leaves of Butea monosperma.[21]

7. CONCLUSION

The studies reveal that Butea monosperma has tremendous potential. This review layout as a documentation for all the properties of Butea monosperma that can be exploited for human welfare. It has been used in herbal medication from ancient age as being mentioned in shushrut samhita. Indigenous people also use plant in their day-to-day life in the form of food, fuel, timber, vegetables, fodder etc. Almost all the parts of this plant provides cure to the diseases from traditional point of view. Its not only beneficial for basic needs but also provides treatments for fatal diseases like diabetes, cancer and helminthiases. It possess various pharmacological activities as antidiabetic, antibacterial, antifungal, antitumor, anti inflammatory, hepatoprotective, anti diarrheal, wound healing properties, antimicrobial, antihelmintic, anticancerous etc.

Butea monosperma contains several phytochemicals such as terpenes, coreopsin, flavonoids, steroids, glucosides, tannins and catechin. It also bears enzymes like lipolytic enzyme, proteolytic enzyme, polypeptidase and lipids like palmitic acid, linoleic acid, lignoceric acid, stigmasterol. B. monosperma express high scavenging activity. The extracts extracted in butanol and ethyl acetate demonstrates significant radical scavenging activity whereas the methanol extract is devoid of any. Hence, B. monosperma is thought to have high therapeutic potential. The clinical research may be provide deep insight into medicinal values of this plant which can be beneficial to human population in coming time.

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