REVIEW ARTICLE

Phytochemistry, pharmacological potential, and therapeutic uses of (Palash) *Butea monosperma*: A review

Apoorva Dubey, Ravi Kant Upadhyay

Department of Zoology, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur, Uttar Pradesh, India

Abstract

The present review aims to comprehensively summarize the botanical characteristics, phytochemical composition, and pharmacological potential of *Butea monosperma*. This plant is commonly known as Palash and is rich in bioactive compounds. Various parts of the plant, including flowers, seeds, bark, and leaves, are rich in bioactive constituents such as flavonoids (butrin, isobutrin, butein), chalcones, glycosides, tannins, and steroids, which contribute to its wide spectrum of biological activities, including hypoglycemic, anti-inflammatory, anti-oxidant, anti-microbial, anti-diabetic, hepatoprotective, anti-cancer, immunomodulatory, and insecticidal. Conventionally, it is also valued for its tonic, astringent, aphrodisiac, and diuretic uses. *B. monosperma* is also recognized for its ecological and economic roles, making it a valuable candidate for sustainable drug development and natural pest control efforts, thus representing a promising source for novel therapeutic agents.

Key words: Bioactive compounds, *Butea monosperma*, Fabaceae, medicinal plant, pharmacological activities, phytochemistry

INTRODUCTION

Butea monosperma (Lam.) Taub, a member of the family Fabaceae, is an important medicinal plant distributed across tropical and subtropical regions of South and Southeast Asia, including India, Nepal, Sri Lanka, Myanmar, and Thailand.[1,2] Commonly known as Palash, Dhak, or the "Flame of the Forest," the plant is easily recognized by its striking orange–red flowers and holds significant cultural, ecological, and medicinal value. *B. monosperma* is a small-to-medium sized, slow-growing deciduous tree, typically reaching 5–15 m in height. It has a short, often crooked trunk with a broad, irregular crown. The leaves are trifoliate, with large, leathery leaflets borne on long petioles. The plant produces bright orange-red, papilionaceous flowers arranged in dense racemes, usually appearing between February and April. The fruit is a flat, elongated pod containing a single seed.[3-5]

It has been revered in traditional systems of medicine, particularly Ayurveda, where various parts of the plant are utilized for the treatment of numerous ailments.[6] The Fabaceae family, one of the largest families of flowering plants, comprises a vast diversity of species known for their nutritional and pharmacological importance. Within this family, *B. monosperma* has gained considerable attention due to its wide range of therapeutic applications.[1] Conventionally, different parts of the plant, such as flowers, seeds, bark, leaves, and roots, have been used to manage conditions such as inflammation, infections, diabetes, gastrointestinal disorders, and skin diseases. Its extensive use in folk and classical medicine systems highlights its potential as a valuable source of natural remedies.[7]

B. monosperma possesses diverse bioactive constituents, including flavonoids, chalcones, glycosides, tannins, and steroids. Major compounds such as butrin, isobutrin, butein, and palasonin are reported to contribute significantly to its pharmacological activities. These compounds are associated with a broad spectrum of biological effects, including anti-oxidant, anti-inflammatory, anti-microbial, hepatoprotective, anti-diabetic, anti-cancer, and

Address for correspondence:
Dr. Ravi Kant Upadhyay, Department of Zoology, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur, Uttar Pradesh, India.
E-mail: rkupadhya@yahoo.com

Received: 22-02-2026
Revised: 22-03-2026
Accepted: 30-03-2026

immunomodulatory properties.[8] In recent years, there has been growing scientific interest in exploring medicinal plants as safer and more sustainable alternatives to synthetic drugs. In this context, *B. monosperma* has emerged as a promising candidate due to its rich phytochemical profile and multifunctional therapeutic potential. Moreover, its applications extend beyond medicine to include ecological, agricultural, and economic benefits, such as use in natural dyes, fodder, and pest management. The present review aims to provide a comprehensive overview of *B. monosperma*, focusing on its botanical features, phytochemical composition, and diverse pharmacological activities. It also highlights the need for further research to validate its traditional uses and to facilitate the development of novel plant-based therapeutic agents.[9]

SOURCE OF INFORMATION

For writing this comprehensive research review on Palash: A holy plant, various databases were searched. For the collection of relevant information, specific terms such as medical subject headings and key text words, such as "Palash (*B. monosperma*) and its therapeutic uses" published till 2025 were used in Medline. Most especially for retrieving all articles about the traditional uses of *B. monosperma* for therapeutics, electronic bibliographic databases were searched, and abstracts of published studies with relevant information on the *B. monosperma* were collected. Furthermore, additional references were included through searching the references cited by the studies done on the present topic. Relevant terms were used individually and in combination to ensure an extensive literature search. For updating the information about a subject and incorporation of recent knowledge, relevant research articles, books, conference proceedings, and public health organization survey reports were selected and collated based on the broader objective of the review. This was achieved by searching databases, including SCOPUS, Web of Science, EMBASE, PubMed, Swiss-Prot, and Google searches." From this common methodology, discoveries and findings were identified and summarized in this final review.

COMMON USES

Beyond its medicinal importance, *B. monosperma* is a versatile multipurpose tree with significant ecological, agricultural, and economic value. The wood, though relatively soft, is durable underwater and is traditionally used for making agricultural tools, well curbs, and household items such as ladles and spoons, particularly in ritual practices. The tree also serves as a good source of fuelwood and charcoal. The plant yields a valuable gum known as "Bengal kino," which is widely used in traditional medicine and as a natural astringent.[10,11] Its flowers are a rich source of natural dye, producing a bright orange–yellow color that is traditionally used in textiles and during festivals such as Holi. The leaves have been historically used as biodegradable plates and packaging material, offering an eco-friendly alternative to plastics. To increase ground stability and stop soil erosion, *B. monosperma* is frequently planted along field boundaries in agriculture. The young leaves and branches are fed to animals. Due to its insecticidal qualities, the plant has also demonstrated promise in managing pests, which makes it helpful in environmentally friendly and sustainable farming methods.[11] In general, *B. monosperma* is crucial for traditional activities, rural livelihoods, environmental preservation, and healthcare.

NUTRITIONAL VALUE

B. monosperma has substantial nutritional value in addition to its medicinal properties since it contains essential minerals, bioactive compounds, and macronutrients distributed throughout the plant. The blooms are a great source of vitamins such as Vitamin C and carotenoids, as well as vital minerals such as iron and zinc, which support immune function and aid in anti-oxidant defense.[12] The significant amounts of fixed oils (about 17–20%), proteins, and enzymes, including lipolytic and proteolytic enzymes, show the nutritional and metabolic value of the seeds. Because they contain crude protein, fiber, and essential minerals, the leaves and stems can be used as additional animal feed. The phytochemical makeup of the plant is rich in flavonoids, phenolic compounds, and tannins. Although these compounds are mostly associated with therapeutic effects, their anti-oxidant activity and metabolic control also contribute to nutritional benefits. Leaves contain apigenin, which alters the metabolism of carbohydrates by inhibiting crucial digestive enzymes.[3]

ESTHETIC USES

B. monosperma is widely utilized in cosmetic and esthetic applications due to its richness of flavonoids, tannins, and other bioactive compounds. Its bark and flower extracts are effective ingredients in natural skincare and haircare products because of their strong anti-bacterial, anti-inflammatory, and anti-oxidant properties.[13] The herb is often used to treat acne, ease skin irritation, and encourage wound healing. Its anti-oxidant properties protect the skin from oxidative stress and premature ageing while improving the skin's overall texture and health. In addition, it encourages the synthesis of collagen, which aids in the repair and regeneration of skin. Extracts from *B. monosperma* are utilized in hair care products to maintain and condition the scalp. The brightly colored flowers also serve as a natural dye and are incorporated into herbal cosmetic products as a safe alternative to synthetic colorants.[14,15]

THERAPEUTIC USES

B. monosperma is widely recognized in traditional and modern medicine for its diverse therapeutic applications, attributed to its rich phytochemical composition. Many plant components, including flowers, seeds, bark, leaves, roots, and gum, are used to treat a variety of illnesses. Intestinal worm diseases and several skin conditions have historically been treated with seeds, which are especially prized for their strong anthelmintic properties. Palasonin and other bioactive substances are important for this action. Furthermore, seed extracts have shown anti-bacterial and anti-fertility qualities. Flowers have strong hepatoprotective, anti-oxidant, and anti-inflammatory properties.[2] They have historically been used to treat illnesses relating to the eyes, skin, liver, and diarrhea. Their function in lowering oxidative stress and blocking inflammatory mediators has also been documented in experimental investigations. Because of its potent astringent qualities, the bark and gum are frequently used to treat hemorrhoids, diarrhea, dysentery, and wound healing. While the gum (Bengal kino) is used as a tonic and to treat gastrointestinal issues, the bark is also said to have anti-inflammatory, anti-ulcer, and anti-diabetic properties. Because of its anti-bacterial and anti-inflammatory qualities, leaves are used to treat skin infections, boils, ulcers, and piles.[16] The plant's roots have long been used to cure gastrointestinal issues, filariasis, and night blindness.[17] *B. monosperma* possesses medicinal benefits, including its anti-diabetic, hepatoprotective, anti-cancer, immunomodulatory, anti-bacterial, and wound-healing properties. Mechanisms include anti-oxidant activity, suppression of inflammatory pathways, immune response modulation, and metabolic enzyme control, which play a major role in mediating these effects.[13]

MEDICINAL USES

In India, Ayurvedic medicinal plants are considered a rich source of ingredients that can be used in drug development as home remedies to treat various diseases, such as diarrhea, constipation, hypertension, dehydration, bronchial asthma, leucorrhea, cancer, infection, as well as liver and stomach disorders. The seed powder is known for its notable medicinal, pharmaceutical, and insecticidal activities. This study highlights the traditional Ayurvedic importance of an eminent medicinal plant, *B. monosperma*, with its active chemical constituents, as well as pharmacological, environmental, ecological, economical, and agricultural significance.[3,18]

PLANT PHYTOCHEMISTRY

B. monosperma is a rich source of diverse bioactive compounds, primarily including flavonoids, chalcones, glycosides, tannins, steroids, and phenolic constituents. Different parts of the plant exhibit distinct phytochemical profiles that contribute to its pharmacological potential. The flowers are particularly abundant in flavonoids and chalcones such as butrin, isobutrin, butein, coreopsin, isocoreopsin, sulfurein, and monospermoside, which are associated with strong anti-oxidant and anti-inflammatory activities. Seeds contain the notable anthelmintic compound palasonin along with fixed oils, fatty acids, and sterols such as β-sitosterol.[19] The bark is rich in tannins, including kinotannic acid, gallic acid, and pyrocatechin, contributing to its astringent properties. Leaves contain various alkaloids, steroids, triterpenes, and phenolic compounds. Compounds such as medicarpin (an isoflavone), lupeol, and stigmasterol have been identified in different plant parts, further enhancing their therapeutic value.[20] Overall, the rich phytochemical composition of *B. monosperma* underpins its extensive use in traditional medicine and supports its potential for the development of novel pharmacological agents.[21]

BIOACTIVE COMPOUNDS

B. monosperma, known for its flowers, seeds, bark, leaves, and gum, is rich in bioactive phytochemicals that contribute to various pharmacological effects. Key components include flavonoids and chalcones found predominantly in the flowers, such as butrin, isobutrin, butein, coreopsin, isocoreopsin, sulfurein, monospermoside, and isomonospermoside [Figure 1], which exhibit anti-inflammatory, anti-oxidant, and anti-cancer properties.[13] The vibrant color of the flowers is attributed to chalcones and aurone derivatives. The bark and gum contain phenolic compounds such as gallic acid, ellagic acid, and kino-tannins, offering astringent, anti-bacterial, and free radical scavenging benefits. Medicinal compounds in the bark, such as medicarpin, cajanin, and isoformononetin, enhance its therapeutic potential. Seeds are notably high in palasonin, an anthelmintic substance, and contain various enzymes and fatty acids such as oleic, linoleic, and palmitic acids.[22] Other bioactive substances, including steroidal and triterpenoid compounds such as lupeol, lupenone, stigmasterol, and β-sitosterol, further contribute to hepatoprotective, hypolipidemic, and anti-inflammatory effects. The extensive phytochemical profile of *B. monosperma* supports its medicinal applications, highlighting its potential for developing innovative plant-based therapies driven by its anti-oxidant, anti-bacterial, anti-diabetic, hepatoprotective, immunomodulatory, and insecticidal properties.[6]

PHARMACOLOGICAL ACTIVITY

Anti-microbial Activity

B. monosperma exhibits significant anti-bacterial properties attributed to its phytochemical composition, including flavonoids, tannins, and phenolic compounds. Various extracts from its leaves, flowers, bark, and seeds display broad-spectrum efficacy against both Gram-positive and

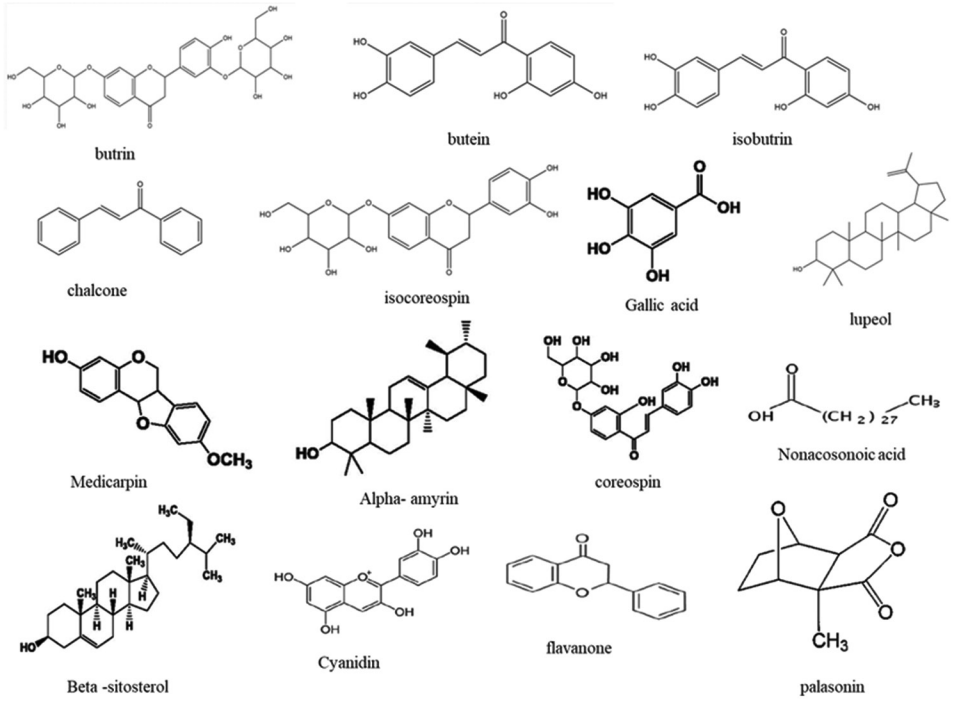

Figure 1: Chemical structure of the bioactive compounds of *Butea monosperma*

Gram-negative bacteria, such as *Staphylococcus aureus* and *Escherichia coli*.[23,24] Ethyl acetate fractions are notably effective against *Staphylococcus*, while methanolic and ethanolic extracts, especially from leaves and flowers, enhance anti-bacterial activity. The plant also shows anti-fungal effects against species such as *Trichophyton mentagrophytes*.[25] Its anti-bacterial mechanism involves microbial cell membrane disruption and biofilm reduction, potentially aiding in overcoming resistant bacterial strains. The bark extract also possesses anti-diarrheal properties (Table 1 showing Distribution of phytoconstituents and their pharmacological effects in various parts of Butea monosperma), likely due to its inhibition of gastrointestinal motility. *B. monosperma* is thus a promising source for developing anti-microbial agents and combating microbial resistance.[24]

Antiviral Activity

Seeds of *B. monosperma* contain a specific flavonoid glycoside 5, 2'-dihydroxy-3, 6,7-trimethoxyflavone-5-O-beta-D-xylopyranosyl-(1→4)-O-beta-D-glucopyranoside that shows potential against virus replication.[3,26]

Anti-inflammatory

The strong anti-inflammatory properties of *B. monosperma* are mainly ascribed to tannins, flavonoids (such as butrin and isobutrin), and other phenolic components. In experimental settings, flower, bark, and gum extracts have shown effectiveness by lowering edema and preventing granuloma development, which suggests regulation of inflammatory responses.[2] The underlying mechanisms include a decrease in pro-inflammatory cytokines and suppression of important inflammatory mediators and enzymes, such as the cyclooxygenase and lipoxygenase pathways. Furthermore, the plant's anti-oxidant qualities help reduce lipid peroxidation and control inflammation linked to oxidative stress.[27] It shows better activity than conventional anti-inflammatory medications.[28]

Anti-diabetic

Numerous experimental research employing various plant parts have demonstrated the strong anti-diabetic potential of *B. monosperma*. In diabetic animals produced by alloxan and streptozotocin, ethanolic and aqueous extracts of leaves, bark, and seeds have been demonstrated to lower blood glucose levels and enhance serum biomarkers and lipid profiles. Flavonoids, phenolic compounds, and other secondary metabolites that increase insulin secretion, improve peripheral glucose utilization, and inhibit important enzymes that metabolize carbohydrates are thought to be responsible for the anti-hyperglycemic action.[29] Furthermore, the extracts exhibit anti-oxidant action by boosting endogenous defense mechanisms, including glutathione and catalase, which lowers oxidative stress linked to diabetes. There is some preliminary clinical evidence that the administration of powdered plant material reduces postprandial blood glucose and serum lipids.[30-32] Despite encouraging outcomes, *B. monosperma* has validity as a trustworthy anti-diabetic treatment, but its validity is limited by the unpredictability of the extract composition, the absence of dose standardization, and the dearth of well-controlled clinical trials.

Table 1: Distribution of phytoconstituents and their pharmacological effects in various parts of *Butea monosperma*

Plant part	Major phytochemical class	Examples (key compounds)	Pharmacological activities	References
Leaves	Fatty acid	Oleic acid, linoleic acid, lignoceric acid; flavonoids	Anti-diabetic, antioxidant, anti-inflammatory	[3,38]
Flower	glycosides	5,7-dihydroxy -3,6,4-trimethoxy flavone-7-O-α-L xylopyranosyl (1→3)-O-α-Larabinopyranosyl-(1→4)-O-β-D galacto pyranoside	Anti-oxidant, anti-inflammatory, hepatoprotective, anti-cancer, anti-hyperglycemic, anti-convulsant	[3,39]
	triterepenes	Butrin, isobutrin, coreopsin, sulfurein, isocoreopsin, monospermoside, chal-cones, isomonospermoside, steroids	Anti-oxidant, neuropharmacological (anti-dopaminergic), hepatoprotective	[2,3,16]
Bark	Tannins, flavonoids, amino acids	Kinotannic acid, palasitrin, cyanidin, histidine	Anti-diarrheal, wound healing, anti-ulcer, anti-inflammatory, osteoprotective	[3,40]
Stem	Sterols, fatty acids	Stigmasterol-β-D-glucopyranoside and nonacosanoic acid	Anti-hyperglycemic and anti-oxidant effect	[38,40]
Seed	Proteins, enzymes, fixed oils	Palasonin, proteolytic enzymes, lipolytic enzymes	Anthelmintic, anti-fertility, anti-hyperglycemic, anti-hyperlipidemic	[1,3]
Sap	Polyphenols, flavonoids	Chalcones, butein, butin	Anti-oxidant, anti-nociceptive, hypoglycemic	[2,3]
Gum	Tannins, polyphenols	Pyrocatechin, kinotannic acid, mucilage	Anti-bacterial, anti-fungal, astringent	[3,22]
Resin	Triterpenoids, esters	Jalaric esters, laccijalaric esters, α-amyrin	Anti-microbial, anti-inflammatory	[3,22]

Anti-cancer Activity

B. monosperma has a high concentration of flavonoids and chalcones, including butein, butrin, and isocoreopsin, which is largely responsible for its encouraging anti-cancer potential. Through a variety of mechanisms, such as cell cycle arrest, apoptosis induction, and regulation of tumor-promoting signaling pathways, these bioactive substances have been demonstrated to impede the growth of cancer cells. Extracts from flowers, leaves, and bark have been shown in experiments to have cytotoxic effects on a variety of cancer cell lines, including lung, breast, colon, and liver malignancies.[3] Mechanistically, these actions include suppression of pathways, including wingless related integration cite (Wnt)/β-catenin and phosphoinositide 3 kinase pathway (PI3K)/AKT serine/threonine specific protein kinases (Akt), as well as modification of important molecular targets such as p53, Bax, and caspases. Furthermore, vascular endothelial growth factor downregulation has been shown to have anti-angiogenic and anti-metastatic effects.[33]

Immunomodulatory

B. monosperma acts through synergistic phytoconstituents to regulate immune responses, primarily by reducing oxidative stress and downregulating pro-inflammatory pathways; however, current evidence remains largely preclinical and requires further validation.[3,34]

Hepatoprotective Activity

The hepatoprotective activity of *B. monosperma* is mostly ascribed to flavonoids that have anti-inflammatory and anti-oxidant properties, such as butein, butrin, and isobutrin. According to experimental research, extracts from the bark, flowers, and leaves improve endogenous anti-oxidant defenses such as glutathione, superoxide dismutase, and catalase and restore serum liver enzymes (alanine transaminase, aspartate aminotransferase, and alkaline phosphatase) to lessen chemically induced hepatotoxicity (such as carbon tetrachloride and paracetamol).[35] Histological evidence points to decreased necrosis and hepatic architecture preservation, but these results are mostly restricted to preclinical animals. Conclusions on its therapeutic relevance are limited by the absence of standardized extracts, dose optimization, and well-designed clinical trials, despite some research reporting efficacy comparable to silymarin.[13,36,37]

Anti-diarrheal Activity

The ethanolic extract of *B. monosperma* bark and stem exhibits significant anti-diarrhoeal activity, effectively reducing

castor oil-induced diarrhea and prostaglandin E2-induced enteropooling in rats. In addition, co-administration with a charcoal meal markedly decreased gastrointestinal motility.[41]

Anti-dopaminergic Activity

B. monosperma demonstrates anti-dopaminergic activity, as evidenced by its extracts reducing dopamine-induced behaviors and locomotor activity in experimental models. This effect is likely attributed to its flavonoid and phenolic constituents, which modulate dopaminergic signaling. An isoflavone isolated from the plant extract has been shown to inhibit foot shock-induced aggression in rats and to potentiate haloperidol-induced catalepsy in a dose-dependent manner.[42]

Anthelmintic Activity

The seeds of *B. monosperma*, which are traditionally used to treat intestinal helminth infections, have significant anthelmintic action. Bioactive components such as palasonin, flavonoids, and phenolic substances are mainly responsible for this activity. Extracts from seeds, leaves, bark, and flowers have been shown in experiments to cause helminths (such *Pheretima posthuma*) to become paralyzed and die, indicating disruption of neuromuscular action. Seed extracts typically have the maximum potency; however, both alcoholic extracts have significant activity against *Caenorhabditis elegans*. A decrease in the burden of gastrointestinal nematodes has been seen in studies, although their effectiveness is still inferior to that of common anthelmintic medications such as levamisole or albendazole. It could be used as a therapeutic alternative to standardized anti-biotic formulations.[43]

Insecticidal

The insecticidal potential of *B. monosperma* has been well investigated, especially because of chemicals derived from the seed, such as the important bioactive ingredient (S)-(-)-palasonin. Palasonin is highly poisonous to *Plutella xylostella* (diamondback moth), even in populations that are resistant to insecticides. This is probably because it interferes with processes linked to protein phosphatases.[36] Other plant sections have pesticidal activity that is ascribed to secondary metabolites such as phenolics, terpenoids, and flavonoids. These substances work through a variety of ways, including inducing cellular toxicity, inhibiting growth and development, and disrupting eating behavior. *B. monosperma* exhibits potential as a botanical insecticide for long-term pest control.[3]

Wound Healing Activity

Extracts from the stem bark and flowers of *B. monosperma* increase tissue regeneration, collagen synthesis, and wound contraction, all of which aid in wound healing. Their anti-oxidant, anti-microbial, and anti-inflammatory qualities enhance tensile strength, decrease lipid peroxidation, and speed up epithelialization. These benefits are driven by important phytochemicals (flavonoids, tannins, and triterpenoids), which are notably effective even in diabetic wound situations.[44] The extract also enhances collagen synthesis and cellular proliferation at the wound site. It promotes wound contraction, shortens epithelialization time in excision models, and increases hydroxyproline content, granulation tissue weight, and tensile strength in incision wounds.[45]

Osteogenic and Osteoprotective Activity

Strong osteogenic and osteoprotective benefits are demonstrated by *B. monosperma* stem bark extract, which promotes bone formation and inhibits bone loss, particularly in postmenopausal osteoporosis models. It increases osteoblast differentiation, mineralization, and bone density without having oestrogenic side effects.[46] It works by activating the Wnt/β-catenin pathway, increasing bone formation markers (such as P1NP), decreasing resorption markers (sch as C- terminal telopeptide of type 1 collagen (CTX)-1), and maintaining bone microarchitecture and strength. Its non-estrogenic, bone-protective properties are attributed to important components such as cajanin.[47]

CONCLUSION

B. monosperma is a pharmacologically significant medicinal plant with a wide range of traditional and experimentally validated therapeutic applications. Its rich phytochemical composition, including flavonoids, chalcones, phenolic compounds, and triterpenoids, underpins diverse biological activities such as anti-oxidant, anti-inflammatory, anti-microbial, anti-diabetic, hepatoprotective, anti-cancer, immunomodulatory, and insecticidal effects. *B. monosperma,* rich in flavonoids, tannins, and bioactive compounds, is extensively used in cosmetic applications, particularly in natural skincare and haircare products. In India, its bark and flower extracts are valued in Ayurvedic medicine for developing home remedies to treat various ailments, including diarrhea, constipation, hypertension, dehydration, bronchial asthma, leucorrhea, cancer, infections, and liver and stomach disorders. Rigorous clinical investigations are essential to validate its safety and therapeutic potential. Overall, *B. monosperma* represents a promising candidate for drug discovery and sustainable applications in medicine and agriculture, warranting further systematic exploration.

ACKNOWLEDGMENTS

The authors are thankful to the HOD and Dean of the Faculty of Science.

REFERENCES

1. Ambastha S, Sharan L. Review on medicinal importance of *Butea monosperma* Lam. (Taub). Def Life Sci J 2023;8:83-92.
2. Jain S, Dubey PK. *Butea monosperma* (Lam.) Taub: Review on its chemistry, morphology, ethnomedical uses, phytochemistry and pharmacological activities. J Drug Deliv Ther 2023;13:137-44.
3. Hiremath KY, Veeranagoudar DK, Bojja KS. *Butea monosperma* as a collective phytomedicine and environmentally sustainable, conservative, and beneficial plant. Arch Razi Inst 2024;79:465-74.
4. Anuragi H, Sundaram S, Arunachalam A, Rajarajan K. Palash (*Butea Monosperma*): A Monograph. India: ICAR-CAFRI Publication; 2023.
5. Sangita B, Moni T, Sadhana K. *Butea monosperma* (Lam.) Taub.: An all-terrain lac host: A review. Agric Res Technol Open Access J 2025;29:556450.
6. Saroj P, Shah N. *Butea monosperma* (Palash): Its ethnobotanical knowledge, phytochemical studies, pharmacological aspects and future prospects. Int J Pharm Sci Rev Res 2023;79:103-11.
7. Wang X, Anwar T, Qureshi H, El-Beltagi HS, Sehar Z, Solieva D, *et al*. Plant-based traditional remedies and their role in public health: Ethnomedicinal perspectives for a growing population. J Health Popul Nutr 2025;44:300.
8. Kambale N, Satpute KL, Wadulkar RD, Jadhav PS, Mali YA. *Butea monosperma* (Palash): A comprehensive review of its botany, phytochemistry, and pharmacological potential. Int J Pharm Sci 2025;3:4131-40.
9. Kumari P, Raina K, Thakur S, Sharma R, Cruz-Martins N, Kumar P, *et al*. Ethnobotany, phytochemistry and pharmacology of *Butea monosperma* (Lam.) Taub.: A systematic review. Curr Pharmacol Rep 2022;8:188-204.
10. Thombare N, Lohot V, Ghosh J, Thakur VV, Pankaj S. Palas (*Butea monosperma*): A medicinally important gum and resin producing tree. J Innov Invent Pharm Sci 2020;1:26-30.
11. Kora AJ. Leaves as dining plates and food packaging material: Importance of renewable resources in Indian culture. Bull Natl Rese Cent 2019;43:205.
12. Tiwari P, Jena S, Sahu PK. *Butea monosperma*: Phytochemistry and pharmacology. Acta Sci Pharm Sci 2019;3:19-26.
13. Kumari G, Kumari S, Sarkar A. *Butea monosperma*: An overview of its bioactive constituents and medicinal applications. Asian J Res Pharm Sci 2026;16:93-7.
14. Sikarwar V, Bhadauria P, Kulshreshtha A, Singh M. Natural paper colorant by *Butea monosperma* flower petals. World J Pharm Pharm Sci 2020;9:1885-91.
15. Krolikiewicz-Renimel I, Michel T, Destandau E, Reddy M, André P, Elfakir C, *et al*. Protective effect of a *Butea monosperma* (Lam.) Taub. Flowers extract against skin inflammation: Antioxidant, anti-inflammatory and matrix metalloproteinases inhibitory activities. J Ethnopharmacol 2013;148:537-43.
16. Dhakad GG, Ganjiwale SV, Nawghare SM, Shrirao AV, Kochar NI, Chandewar AV. Review on *Butea monosperma* plant and its medicinal use. Res J Pharmacol Pharmacodynam 2023;15:69-72.
17. Garg I, Rawat S, Chaurasia U, Ram V. Phytomolecules, pharmacology, and medicinal values of the *Butea monosperma* (Palash) flower. Curr Chem Biol 2025;20:25-41.
18. Chauhan S, Mahish P. Flavonoids of the flame of forest *Butea monosperma*. Res J Pharm Technol 2020;13:5647-53.
19. Bhattacharya S, Chakraborty S, Pal R, Roy A, Bhattacharjee A. Tannins containing medicinal plants and it's significance: An overview. J Emerg Technol Innov Res 2022;9:a340-50.
20. Farooq MU, Mumtaz MW, Mukhtar H, Rashid U, Akhtar MT, Raza SA, *et al*. UHPLC-QTOF-MS/MS based phytochemical characterization and anti-hyperglycemic prospective of hydro-ethanolic leaf extract of *Butea monosperma*. Sci Rep 2020;10:3530.
21. Methaniya D, Rathore R, Solanki H. *Butea monosperma*: Ethnomedicinal studies and pharmacology. Int Assoc Biol Comput Dig 2023;2:222-9.
22. Khan Z, Zeb A, Sheikh F. Phytochemical properties and biological activities of *Butea monosperma*. Indus J Bio Res 2025;3:10-7.
23. Sahu MC, Padhy RN. *In vitro* antibacterial potency of *Butea monosperma* Lam. Against 12 clinically isolated multidrug resistant bacteria. Asian Pac J Trop Dis 2013;3:217-26.
24. Puri ES, Rani AS, Sulakshana G. Evaluation of antibacterial potential of *Butea monosperma* leaf extract. Int J Sci Res Biol Sci 2021;8:59-61.
25. Yadava R, Tiwari L. Note: A potential antiviral flavone glycoside from the seeds of *Butea monosperma* O. Kuntze. J Asian Nat Prod Res 2005;7:185-8.
26. Avula M, Babu K, Shankar T, Pallu R, Reddy G, Latha J. *In vitro* and *in vivo* anti inflammatory activity of *Butea monosperma* stem bark extract. Int J Pharm Pharm Sci 2010;2:96-9.
27. Zahra N, Mazhar A, Zahid B, Naeem MA, Sarwar A, Aziz T, *et al*. Evaluation of influence of *Butea monosperma* floral extract on inflammatory biomarkers. Open Chem 2024;22:20230199.
28. Ahmed F, Siddaraju NS, Harish M, Urooj A. Effect of *Butea monosperma* Lam. leaves and bark extracts on blood glucose in streptozotocin-induced severely diabetic rats. Pharmacognosy Res 2012;4:33-6.
29. Sharma N, Garg V. Antihyperglycemic and antioxidant effect of hydroethanolic extract of *Butea monosperma* bark in diabetic mice. Indian J Biochem Biophys 2012;49:55-62.
30. Bavarva JH, Narasimhacharya AV. Preliminary study on antihyperglycemic and antihyperlipaemic effects of *Butea monosperma* in NIDDM rats. Fitoterapia 2008;79:328-31.

31. Choedon T, Shukla SK, Kumar V. Chemopreventive and anti-cancer properties of the aqueous extract of flowers of *Butea monosperma*. J Ethnopharmacol 2010;129:208-13.
32. Sehrawat A, Kumar V. Butein imparts free radical scavenging, anti-oxidative and proapoptotic properties in the flower extracts of *Butea monosperma*. Biocell 2012;36:63-71.
33. Singh A, Kaur M, Choudhary A, Kumar B. Effect of *Butea monosperma* leaf extracts on cyclophosphamide induced clastogenicity and oxidative stress in mice. Pharmacognosy Res 2015;7:85-91.
34. Kaur V, Kumar M, Kaur P, Kaur S, Singh AP, Kaur S. Hepatoprotective activity of *Butea monosperma* bark against thioacetamide-induced liver injury in rats. Biomed Pharmacother 2017;89:332-41.
35. Fan Q, Li X, Wei C, Wang P, Sun H, Zheng S, *et al*. Extraction, structure characterization and biological activity determination of (S)-(-)-palasonin from *Butea monosperma* (Lam.) Kuntze seeds. Ind Crops Prod 2022;187:115393.
36. Rahman HS, Othman HH, Hammadi NI, Yeap SK, Amin KM, Abdul Samad N, *et al*. Novel drug delivery systems for loading of natural plant extracts and their biomedical applications. Int J Nanomedicine 2020;15:2439-83.
37. Sharma M, Kumari R, Saxena PK. Pharmacognostic study of *Butea monosperma*: A versatile medicinal plant. Res J Pharm Technol 2023;16:5828-33.
38. Jain S, Gupta N, Jain UK, Raghuvanshi AS, Patel A. Anti-Inflammatory Activity of *Butea monosperma* Leaves. Res J Pharmacol Pharmacodynam 2010;2:351-2.
39. Mondal S, Ganguly A, Nandi A, Das A, Mondal S, Mukherjee S, *et al*. Network pharmacology and molecular docking reveal multi-target mechanisms of *Butea monosperma* stem bark extract in ulcerative colitis. Sci Rep 2025;15:40302.
40. Gunakkunru A, Padmanaban K, Thirumal P, Pritila J, Parimala G, Vengatesan N, *et al*. Anti-diarrhoeal activity of *Butea monosperma* in experimental animals. J Ethnopharmacol 2005;98:241-4.
41. Velis H, Kasture A, Maxia A, Sanna C, Mohan M, Kasture S. Antidopaminergic activity of isoflavone isolated from *Butea monosperma* flowers. Plant Med 2008;1:159-68.
42. Mendhe BB, Nema U, Gupta P, Gandhare BR. Evaluation of Anthelmintic activity of leaf extracts of *Butea monosperma*. Int J Pharm Sci Res 2011;1:69-72.
43. Sumitra M, Manikandan P, Suguna L. Efficacy of *Butea monosperma* on dermal wound healing in rats. Int J Biochem Cell Biol 2005;37:566-73.
44. Gavimath CC, Sudee HV, Ganapathy PS, Rai SP, Ramachandra YL. Evaluation of wound healing activity of *Butea monosperma* lam. Extracts on rats. Pharmacologyonline 2009;2:203-16.
45. Maurya R, Yadav DK, Singh G, Bhargavan B, Murthy PS, Sahai M, *et al*. Osteogenic activity of constituents from *Butea monosperma*. Bioorgan Med Chem Lett 2008;19:610-3.
46. Pandey R, Gautam AK, Bhargavan B, Trivedi R, Swarnkar G, Nagar GK, *et al*. Total extract and standardized fraction from the stem bark of *Butea monosperma* have osteoprotective action: Evidence for the nonestrogenic osteogenic effect of the standardized fraction. Menopause 2010;17:602-10.

Source of Support: Nil. **Conflicts of Interest:** None declared.