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SHORT REVIEW

Therapeutic Benefits of *Palash* (*Butea monosperma*): A Review of its Pharmacological Activities

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Abstract

One of humankind's first recognized medicinal needs for long-term health is herbs, which form the basis of current medicine. Worldwide, there is a need and desire for nutritious diets with extra benefits. *Palash* is one such significant plant that can be found in various places. Since ancient times, the Fabaceae family plant known as *Palash* (*Butea monosperma* Lamk. Taub.) has been utilized for medicinal purposes. It can be used for festivals and God worships in most of India's regions. The properties and modes of action of the plant's bioactive components, which include flavonoids, steroids, and other kinds of phytochemicals, will determine how it could be used. Scientific studies using pharmaceutical preparations have demonstrated the medicinal benefits of traditional plant parts, including leaves, flowers, seeds, bark, roots, and gum. These preparations have been found to possess anti-fungal, anti-microbial, anti-inflammatory, antioxidant, anti-diabetic, anti-bacterial, wound-healing, and diuretic properties, among many other qualities.

Keywords: Anti-inflammatory, Antioxidant, Flavonoids, Steroids, Therapeutic Uses

1. Introduction

From the dawn of humanity, *Ayurveda* has touted the importance of the connection between people and therapeutic plants[1]. Most of the world's medicinal plants come from India. *Ayurveda*, *Siddha*, and the *Unani* system are three of India's traditional medical systems. Various ancient books, including the Vedas, refer to medical systems. Between 2500 and 500 BC, in India, the *Ayurvedic* idea emerged and evolved[2]. As much as 60% of the global population uses alternative medicine[3]. In contrast to the approximately 700,000 practitioners of contemporary medicine, there are presently around 250,000 registered physicians of the *Ayurvedic* method[4]. Because of its all-natural composition and few side effects, herbal therapy is currently popular in both developing and developed nations[5]. The treatment of cancer, diabetes, malaria, cardiovascular disease, wound healing, stress relief, and neurological disorders are only some of the pharmacological objectives that continue to find promising new therapeutic targets in the realm of medicinal plants[6]. Herbal medicines and dietary supplements are two examples of the many things that people use as a form of alternative medicine. Dietary supplements are those that aim to augment a person's food intake and include dietary elements (such as vitamins, minerals, botanicals, amino acids, and so on) or components of these items[7]. *Palash* (*B. monosperma*), also called Bastard Teak and generally known as "Flame of the forest", is one of several medicinal plants suggested for the treatment of many ailments in *Ayurveda*. The Fabaceae family has this medium-sized tree among its members[8].

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2. Introduction of *Palash*

Butea monosperma is the scientific name for this plant, which is also known as *Butea frondosa* Koenig ex Roxb. *Ayurvedic* practitioners sometimes make use of the plant *Palash*, whose scientific name is *B. monosperma* Lam. The lovely look of flowers is referred to by the genus *Butea*[9]. *Butea superba*, *Butea parviflora*, *Butea frondosa*, and *B. monosperma* are members of the other *Butea* genus that are found throughout India[10].

Throughout India, you may find the *Palash*, a deciduous tree of medium size that grows to a height of 10-15 meters and is a member of the Fabaceae family. According to Narahari in Raj Nighantu, there are three varieties of *Palash*: red, white, and yellow (Figure 1)[11]. White is the most common while yellow is the least common among the kinds. The yellow species is at risk of extinction, while the red type, also known as the flame of the forest, is plentiful and widely used in medicine[12].

3. Detailed Botanical Information on the *Palash* Plant and its Components

The *B. monosperma* tree is a small to medium-sized short-lived tree that may reach a height of 49 feet (5-15 meters; maximum height: 20 meters). Its trunk is typically twisted, crooked, and marked by unequal branches. The bark is rough, greyish-brown, and fibrous, and it displays a reddish exudate. The branchlets are densely pubescent. The average yearly development of a young tree is only a few feet, so you can expect this tree to take its time maturing. In general, the flowers have an orange-red colour[13,14].

Figure 1. Yellow, red and white. Palash flowers.

Flowers: The flowering season begins in February and continues until the closing week of April. Its diameter is around 2–4 cm. These will be packed closely together on stems without leaves[15].

Leaves: In December, the leaves reapers have vanished, measuring around 15-20 cm by 10cm x 15cm. The leaves are big, stipulated, and have three leaflets. The leaflets have a smooth surface on top and a finely silky texture with prominent veining underneath, forming a cunnate or deltoid base[15].

Fruit: The fruit is a pod that does not split open, with a stalk, and is covered in short brown hair. When ripe, it turns a pale yellowish- or grey colour, and the lower part is flat, with just one seed near the top. The seed is ellipsoid in shape and flattened, measuring approximately 3 cm in length[16].

Seed: The seeds have a flat and kidney-shaped appearance. The seeds vary in size, measuring between 24 to 45 mm in length, 1 to 3 mm in width, and 1 to 2 mm in thickness. The seed coat is a dark reddish-brown colour. The thin, glossy hilum can be found at the centre of the bulb edge of the seed. It has a faint odour and a slightly acrid and bitter taste[17].

4. *Palash* by its Common Name

Paalasha, Kimshuka, Raktapushpaka (*Ayurvedic*); *Dhaak, Samagh Dhaak, Kamarkas (Unani); Palasam, Purasus, Pilasu* (Tamil*); Kimsuka, Brahma Vrksa, Karaka* (Sanskrit); Flame of forest, Parrot Tree, Bastard teak, *Bengal kino* (English); *Palas, Tesu, Dhak* (Hindi); *Kimsuk, Palas* (Bengali); *Keshu, Chichra* (Punjabi); *Moduga* (Telugu); *Kesudo,Khakharo* (Gujarati); *Palashpapra* (Urdu); *Muthuga* (Kannada.); *Pangong* (Manipuri)[17].

5. Exploring the Phytochemical Components of *Palash*

The phytochemicals included in plant-based foods were highly appealing. It helps keep illnesses at bay by releasing reactive oxygen species, which are harmful byproducts of aerobic metabolism and cause oxidative stress[18]. To enhance the efficacy of treatments, phytochemical studies of plants are necessary. Plants can have physiological effects on humans and certain of their components have medical potential due to the chemicals they contain[19].

Table 1. The pharmacological effects of parts of *Palash*[22]

Part of Plant	Pharmacological Activities
Leaves	Anti-inflammatory activity, antioxidant activity, anti-diabetic activity, anti-microbial activity
Flowers	Anti-diabetic activity, anti-inflammatory activity, antioxidant activity, anti-cancer activity, anti-asthmatic activity, anti-stress activity
Seed	Anti-hyperglycemic activity, anti-viral activity, anti-microbial activity, anti-inflammatory activity, contraceptive
Stem and Bark	Anti-diabetic activity, anti-diarrhoeal activity, anti-inflammatory activity, anti-stress activity, anti-fungal activity, anti-ulcer activity, wound healing activity, anti-obesity
Fruit	Hyperglycaemic activity, anti-diabetic activity, anti-microbial and fungal activity, and anti-helminthic activity
Gum	Anti-microbial activity

Quinones, alkaloids, carbs, flavonoids, phenols, proteins, tannins, terpenoids, and cardiac glycosides are all present in the flower[19].

The leaves contain a variety of compounds, including caffeine, tannins, saponins, carbohydrates, glycosides, proteins, phytosterols, and anthraquinones[20].

Compounds found in the stem include carbs, alkaloids, glycosides, flavonoids, terpenoids, steroids, phenols, and saponins[21].

Palash is a multi-pharmacological plant with several different components (Table 1). The anti-inflammatory, antioxidant, and anti-diabetic effects of the flowers are well-known, while the antibacterial and anti-inflammatory actions of the leaves and the anti-viral activity of the seeds are also noteworthy. The potential of *Palash* in creating therapeutic agents for many health disorders is highlighted by these activities, which verify its historic applications in *Ayurveda* and folk medicine. The plant's long history of usage in traditional medicine also suggests it may provide natural solutions to some of the problems affecting modern health care. The following is a description of the pharmacological effect of several elements of the *Palash* plant.

5.1 Leaves

The leaves of the *Palash* tree (Figure 2) have powerful medicinal effects, such as those against inflammation, diabetes, and microbes. These actions are described in some detail below.

5.1.1 Antioxidant Activity

The leaves of the *B. monosperma* plant have potent antioxidant capabilities. The presence of flavonoids and phenolic chemicals is mainly responsible for the antioxidant action. These chemicals lessen oxidative stress by scavenging free radicals. The protective effect against cell damage and chronic illness is due to the antioxidants found in *Palash* leaves, which work by destroying free radicals. In several in vitro tests, researchers found that leaf extracts significantly increased antioxidant activity[23].

Figure 2. *Palash* leaves.

5.1.2 Anti-inflammatory Activity

Inflammation has since been proven to be a common allergic reaction that has persisted for decades. Redness, heat, swelling, and pain are the four classical signs of inflammation. Histamine, bradykinin, and prostaglandins are only a few of the factors produced by different tissues that might trigger inflammation. Inhibition of mediators of inflammation and decrease of oxidative stress are the mechanisms responsible for the anti-inflammatory action. To decrease inflammation, the extracts block the production of enzymes and cytokines that promote it. Inflammation models, including carrageenan-induced paw oedema, have demonstrated substantial anti-inflammatory benefits in response to leaf extracts[24].

5.1.3 Anti-diabetic Activity

Traditional medicine makes use of the *B. monosperma* leaves to control blood sugar levels. Type 2 diabetic rats

showed an increase in blood insulin levels after ingesting an ethanol-based extraction of *B. monosperma* leaves, which also increased hepatic glycogen production and promoted insulin release in isolated rat islets[25]. The anti-diabetic action is associated with bioactive chemicals that aid in glucose regulation. Reduced blood glucose levels are the result of the extracts' ability to increase insulin production and improve glucose absorption by cells, the mechanisms by which they exert their anti-diabetic effects[26].

5.1.4 Anti-microbial Activity

The leaves of *B. monosperma* are effective against many different types of bacteria and fungi. Flavonoids and other bioactive chemicals are responsible for the antibacterial action. The action is because the leaf extracts break down the cell walls of microbes and stop them from making proteins and enzymes that they need to survive. Research conducted in a controlled laboratory setting has shown that extracts from leaves may effectively combat many microorganisms, including fungi and common pathogenic bacteria[27].

5.2 Flowers

The pharmacological properties of *Palash* flowers (Figure 3) are well-known, and they include a long list of benefits, including those against diabetes, inflammation, oxidants, cancer, asthma, stress, and many more. The following is a comprehensive description of these activities.

5.2.1 Anti-diabetic Activity

Traditional medicine practitioners have long relied on *Palash* flowers for their anti-diabetic properties. The antioxidant enzyme activities were enhanced, blood glucose and serum cholesterol were considerably lowered, and an ethanolic extract of *B. monosperma* flowers improved HDL cholesterol. Reduced levels of blood sugar and enhanced insulin sensitivity are benefits of flower extracts. The process that drives this effect is improving insulin secretion and making it easier for tissues to absorb glucose[28-30]. Also, rats fed a high-fat diet, or diabetic rats caused by streptozotocin exhibited lipid-lowering and anti-diabetic effects when treated with a methanolic extraction of *B. monosperma* flowers[31]. Research on diabetic animals has revealed that extracts of flowers considerably reduce blood glucose levels. Against alloxan-induced diabetic Wistar mice, the ethanol-based extract of *B. monosperma* flower exhibited antidiabetic activity[32].

Figure 3. *Palash* flowers.

5.2.2 Anti-inflammatory Activity

Hydroalcoholic extracts of *B. monosperma* flowers and an enhanced fraction of butrin and isobutrin showed anti-inflammatory activity by reducing the release of pro-inflammatory cytokines, matrix metalloproteinase, and prostaglandin synthesis[33]. *Palash* flowers are believed to have anti-inflammatory effects since they can stop the production of mediators that make you feel sick. Reduced synthesis of prostaglandins and leukotrienes is the mechanism of this action[34].

5.2.3 Antioxidant Activity

This floral aqueous extract has antioxidant activity when analyzed and made using soxhlet, decoction, ultrasonic, and maceration procedures[35]. Because of their high concentration of flavonoids and phenolic components, *Palash* flowers have powerful antioxidant properties. These chemicals decrease oxidative stress by scavenging free radicals[36].

5.2.4 Anti-cancer Activity

Significant anti-cancer characteristics are exhibited by the bioactive chemicals found in *Palash* flowers, which induce apoptosis and suppress cell growth. Dry *B. monosperma* flowers were ground into an aqueous extract and tested for anti-inflammatory, pro-apoptotic, hepatoprotective, anti-proliferative, and anticancer effects. In cancer cells, they cause the cell cycle to arrest and increase apoptotic cell death[37]. Incorporating PMA into the cells of breast cancer MCF-10A and MCF-7 causes them to produce COX-2, and PKC's overall activity has anti-cancer characteristics[38]. Potential anti-cancer effects may be suggested by the observed cell proliferation, increase in the G1 phase, and substantial stimulation of apoptotic cellular death[39].

5.2.5 Anti-asthmatic Activity

Traditional uses of *Palash* flowers include the treatment of asthma and other respiratory illnesses. The rise in the overall cellular count, nitrate, total protein, and albumin concentrations in bronco alveolar fluids in rats was decreased by the N-butanoic component of *B. monosperma*, according to a study[40]. The extracts alleviate inflammation in the airways and aid in bronco-dilation. Research has shown that floral extracts can help reduce asthma symptoms[41].

5.2.6 Anti-stress Activity

The water-soluble portion of the ethanolic extract of *Palash* flowers attenuated the elevation of brain serotonin and plasma corticosterone levels induced by water immersion stress, which was comparable to the effects of diazepam. The flowers of *Palash* have adaptogenic properties that help to mitigate stress by modulating the Hypothalamus-Pituitary-Adrenal (HPA) axis[42,43].

5.3 Seeds

Significant pharmacological capabilities, including anti-viral, anti-inflammatory, anti-microbial, and contraceptive effects, are demonstrated by *Palash* seeds (Figure 4). A thorough explanation of these activities is found here.

5.2.7 Anti-hyperglycemic Activity

Palash seeds have several mechanisms that work together to reduce blood sugar levels, including increasing insulin secretion, decreasing carbohydrate metabolism enzyme activity, increasing insulin sensitivity, and acting as an antioxidant[44]. The oral administration of ethanolic soxhlet to sheep infected with a variety of gastrointestinal nematodes for 1, 2, and 3 g/kg had an antihyperglycemic effect, while rats with Non-Insulin-Dependent Diabetic Mellitus (NIDDM) demonstrated glucose tolerance after 4 to 5 weeks of therapy[45]. Glucose levels were significantly reduced in diabetic rat models when *Palash* seed extracts were administered. Insulin secretion and hepatic glycogen storage were both shown to improve in the trials. There has been encouraging evidence from small-scale clinical studies on people. *Palash* seed extracts improved glucose control in type 2 diabetic participants who took them regularly.

Figure 4. *Palash* seeds.

5.2.8 Anti-viral Activity

Extracting a possible antiviral flavone glycoside from *B. monosperma* seeds gives them antiviral action[46]. Researchers found that *B. monosperma* seed methanolic extracts significantly inhibited Hepatitis C virus replication. The flavonoids in the extracts prevent the virus from replicating and from entering the body[47]. According to several studies, *Palash* seed extracts can effectively combat both types of Herpes Simplex Virus (HSV)[48]. Initial research indicates that flavonoids, one of the several components found in *Palash* seeds, may have an inhibitory effect on HIV replication. The opposite transcriptase enzyme is essential for viral replication, and these chemicals may inhibit its activity[49].

5.2.9 Anti-microbial Activity

Palash seeds, or *B. monosperma*, have pharmacological antibacterial action, which means they can fight against diseases caused by bacteria and fungi. Extraction from *Palash* seeds has powerful antimicrobial properties, according to research. When it comes to killing germs, both gram-positive and gram-negative, the methanolic and ethanol-based extracts shine. Glycosides, flavonoids, and phenolic chemicals are responsible for the antibacterial effects. Several fungal species, such as *Candida albicans* and *Aspergillus niger*, were found to be inhibited by the antifungal activity of *Palash* seeds. Because of the bioactive chemicals that interfere with the integrity of fungal cell membranes and prevent spore germination, the antifungal effects are seen[50].

5.2.10 Anti-inflammatory Activity

The un-saponified component, combined acids, and settled oil extracted from *B. monosperma* seeds of plants exhibited anti-inflammatory characteristics. These actions are successful in removing the granuloma that

carrageenin and cotton pellets produce in the paws of rats[51]. Research has demonstrated that *Palash* seed extracts can decrease concentrations of inflammatory response-involved pro-inflammatory cytokines such as TNF-α, IL-1β, and IL-6[52].

5.2.11 Contraceptive Activity

During the implantation stage, butin, which is extracted from *B. monosperma* seeds, has anti-conception and post-coital anti-implantation effects in pregnant rats[53]. As an analogy, *B. monosperma* powdered seeds led to ovarian disintegration when administered topically. Most follicles lack maturity, as seen by their immature nuclei and nucleoli within the ovum[54]. *B. monosperma* seed extracts can reduce fertility, according to studies[55]. This is because they interfere with spermatogenesis in men and ovulation in women. The reproductive system might be impacted by the seed extract's potential effects on hormone levels, such as a decrease in testosterone in men and an increase in estrogen in women. As a post-coital contraceptive, the seed extracts have demonstrated an action that inhibits the implantation of fertilized eggs in the uterus[56].

6. Instructions for Utilising *Palash*

Palash is available in a variety of forms that may be customized according to our specific requirements. These include decoctions of the bark, juice from the leaves, gum, powdered flowers, powdered seeds, and churn[57,58].

7. Important Considerations for *Palash* Tree

Palash tree and its parts should be avoided for allergic reactions, pregnancy, and children and elderly individuals under the supervision of a qualified doctor, as there is limited scientific evidence on its safety during these conditions[58].

8. Conclusion

Ultimately, the wide range of pharmacological effects exhibited by different parts of the *Palash* plant highlights its considerable potential in the field of medicine. The *Palash* plant (*B. monosperma* Lam.) is a prime instance of the therapeutic potential that can be discovered in traditional medicinal plants. The flowers, leaves, and seeds of this plant have been widely recognized for their medicinal properties in *Ayurveda* and folk medicine. These properties include anti-inflammatory, antioxidant, anti-diabetic, antibacterial, and antiviral effects. The plant's bioactive substances, including flavonoids and steroids, are essential for its therapeutic effectiveness. *Palash* possesses properties that make it a valuable natural source for the creation of therapeutic agents to treat various health disorders. Its significance for current medical applications remains strong.

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