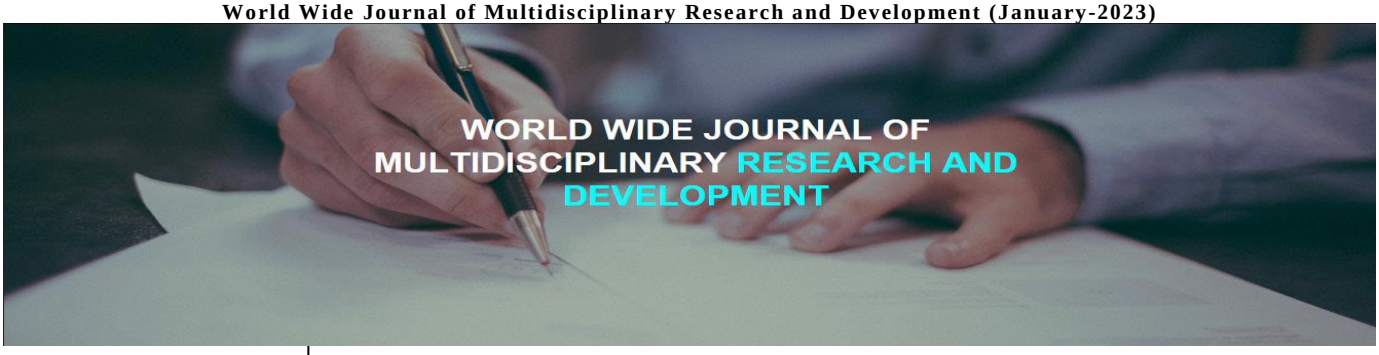

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Butea monosperma (Palash) – Its Ethnobotanical Knowledge, Phytochemical Studies, Pharmacological Aspects and Future Prospects

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Abstract:
The Flame of the Forest is a common name for *Butea monosperma* (Palsh), a member of the Fabaceae family. There are four types of Palash viz. Rakta (red), Pita (yellow), Shweta (white) and Nila (blue) as mentioned by Narahari in Raj Nighantu. The different parts of plant and extract have been utilizing in Unani, homeopathy, and traditional system medicine since a long year ago. Flavonoids are very important naturally occurring polyphenol and are active biomolecules with medicinal values. The flower and bark of *B. monosperma* contain flavonoids such as butin, butrin, isobutrin, and butein. Additionally, this plant has phytoconstituents such steroids, amino acids, glycosides, alkaloids, flavonoids, phenolic compounds and others. Flowers, seeds, bark, fruits, leaves and other plant parts prominently display the pharmacological activities such as antidiarrhoel, anticancer, anticonvulsant, antidiabetic, free radical scaving, antitumour, anti-toxicity, hepatoprotective, antidopaminergic, antihepatoprotective, anti-inplantation, liver disorder, anti-inflammatory, anti-oxidant, antidiabetic, filarial, anti-inplantation, antihelmenthic, antihyperglycaemic, antiviral, antimicrobial, anti-inflammatory, antidiarrhoel, anti-inflammatory, anti-stress, antifungal, antiulcer, wound healing, osteogenic, thyroid inhibitors & hypoglycaemic, anti-obessity, hyperglycaemic, antidiabetic, antifungal, antihelmenthic and antimicrobial activity.

Keywords: *Butea monosperma*, traditional uses, medicinal uses, phytochemical constituent, isolated compounds, pharmacological activity, future prospects.

Introduction:

Butea monosperma (Palash) is a deciduous and a tree of average size that can reach heights of 20–50 ft. The bark is usually rough and greyish, and the trunk is frequently crooked and twisted with uneven branches. The leaves are Pinnate and 8-16 cm in length with three leaflets. Due to its brilliant, appealing blossom colour the name "Kinshuk" has been given to this plant. Palash was explained in detailed in various Samhitas and Nighantus (Ahire *et al*., 2020). There are four types of palash - Rakta (red), Pita (yellow), Shweta (white) and Nila (blue) as mentioned by Raj Nighantu. The Shweta and Nila are rare. Pita variety becomes endangered and abundantly available. Rakta variety is commonly used in medicines, and it is called as “flame of the forest” (Pawar *et al*., 2019). In many regions of India, it is used in worship of God in a different way. According to an ancient science of life (Ayurveda) there is always scientific theory behind celebrating any festivals and Aacharyas have scientific view for using any drug as medicine. The Rakta Palash flowers are used for ‘Holi’ i.e., festival of colour in India. The thought behind it was that the colour prepared from flowers is natural, good for skin and has no adverse effect (Wanjari *et al*., 2016). For the purpose of preventing pregnancy and controlling fertility in both men and women, modern biomedicine has provided various preventative and effective contraceptive properties, but the likelihood of success and effect is relatively low. It is claimed to be the guru of well-honed herbal knowledge in the Indian region of Palashi (West Bengal), and the tree is a manifestation of the god of fire Agnidewa. He received a curse from the goddess Parvati for upsetting her. The Butea genus includes *Butea monosperma parviflora*, *Butea minor*, and *Butea Superba*, all of these are widely distributed throughout India. The flowers are frequently employed in

unani, homopathy and traditional systems of medicine. They are also utilised in hepatic or liver disorders, diarrhoea and other conditions. The method of contraception is generally the most convenient manner, although it is typically acquired to prevent or delay pregnancy. It plays a significant part in the contraceptive property in both male and female to prevent conception. It is used in medicines for the treatment of malignant tumor, diabetes, nausea, abdominal pain and headache, etc (Yadav *et al*., 2020).

Fig.1: ***Butea monosperma*** **(Palash) plant.**

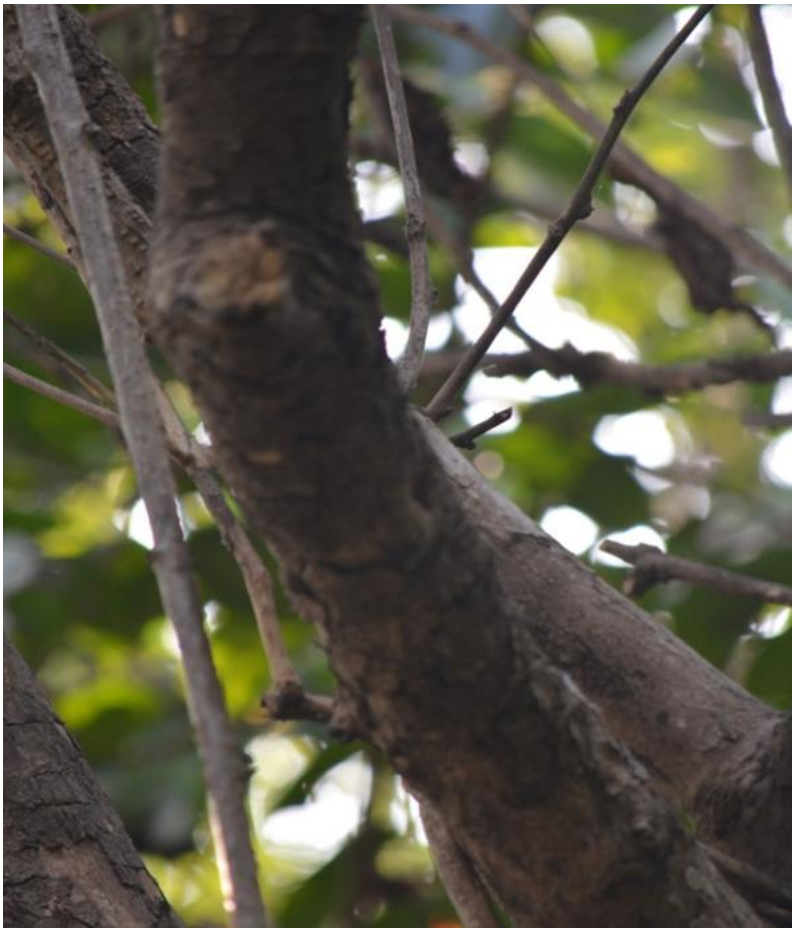

Fig. 2: ***Butea monosperma*** **Trunk.**

Fig.3: ***Butea monosperma*** **Leaves.**

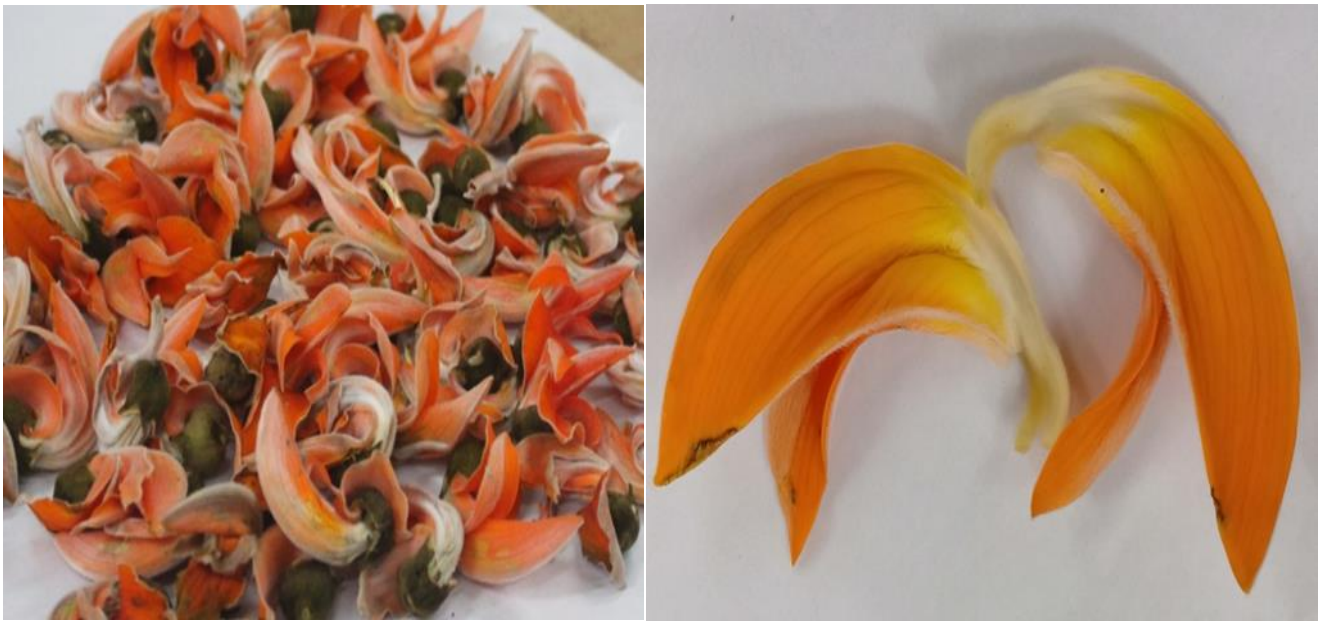

Fig.4: ***Butea monosperma*** **Flowers.**

Table 1: Taxonomic rank of *Butea monosperma*.

Kingdom	Plantae
Subkingdom	Angiosperms
Superdivision	Eudicots
Division	Rosids
Order	Fabales
Family	Fabaceae
Genus	*Butea*
Species	*B.monosperma*

Occurance:

B. monosperma can be found in South Asia and the Indian Subcontinent's tropical and subtropical regions. It can be found in India, Pakistan, Nepal, Bangladesh, Srilanka, Myanmar, Thailand, Malaysia, Laos, Cambodia, Vietnam. It is also found in Wastern Indonesia (Kunjam *et al*., 2021).

Botanical Description:

This tree grows maximum upto 40- 50 ft high with cluster of flowers. It is a slow growing tree, grows in full sun and the growth rate is few feet per year. The leaves of this plant are pinnate, compound with three leaflets, obliquely ovate and broadly elliptic in shape. By December leaves reapers which has been disappeared and it ranges in size from 15-20cm by 10cm x 15cm. The impressive orange and scarlet blossoms, which have a diameter of 2 to 4cm, create a gorgeous canopy on the tree's upper section. The blooming of the flowers starts in February and lasts until the end of April. The fruits of *B. monosperma* has a stalked pods and

flat legumes that range from 12.5-20 by 2.5- 5cm and thick in structure containing a single seed. The seeds are 1.5 to 2 mm thick, 15 to 25mm broad, and between 25 and 40mm long (Pawar *et al*., 2019). Two substantial cotyledons in a big, wrinkled, reddish-brown colour make up the seed coat. The lateral roots are abundant, well-developed, and have thick, lengthy taproots. A sort of red fluid known as "Butea gum" or "Bengal kino" oozes out when the bark is damaged (Verma *et al*., 2017).

Medicinal Uses:

Butea monosperma is a cynosure of contemporary medicine and is utilised in Ayurveda, Unani and homoeopathic treatments. This genus' plants are well recognised for their pigmentation and they are planted as an ornamental because of its sulphur-coloured flower. It is commonly used in asntonic, astringent, aphrodisiac and diuretics. Their seeds act as an inflammation and it is helpful in the treatment of tumours, intestinal worms, bleeding piles, urinary stones, skin and eye conditions, and gastrointestinal problems. Rubefacient properties are exhibited by seeds when mashed with lemon juice and applied on the skin. Flowers are use in the treatment of liver disorders. In India farmers use this plant to stabalize the field bunds. Root shows analgesic, aphrodisiac and antifertility activities which are useful in filariasis, piles, night blindness, ulcer, helminthiasis and tumours. Bark fibre is employed in the production of paper, cordage, and caulk for boat seams. Although leaves are high in nutrients and can be utilised as a moderate fuel, their limited digestibility makes them just slightly more digestible than straws. The wood is burned to make gunpowder (Chouhan *et al*., 2021).

Traditional Uses:

Roots of *Butea monosperma* is used to treat night blindness and elephanthiasis. Leaves are used in the treatment of eye disease, it is an effective astringent, antibacterial, and used to cure pimples (Dwivedi et al., 2016). Bark or stem has antifungel properties and they are use in case of bone fractures, to treat the disease of anus, dysentery, hydrocele, piles, cure ulcer and tumours. Flowers shows antiestrogenic activity, they are sweet, bitter, acrid, astringent to bowls, increase “Vata” and decrease “Kapha”, it is useful in liver disorder, burning sensetaion, thurst, gout and skin diseases. Gum of this tree is anthelmintic, used in throat infection, diarrhoea and dysentery. Fruits can be useful in diseases related to urine, piles, worms and abdomen. Seed shows anthelmintic and laxative activity (Jain *et al*., 2010).

Phytochemical Constituents:

Phytochemicals had great deals of attraction in greenery food. It plays role in preventing diseases, causes and oxidative stress release the reactive oxygen species which contains single oxygen of various radicals as a damaging side effect of aerobic metabolism (Thilagavathi *et al*., 2015). Phytochemical analysis of plant is required to improve the therapeutical efficiency. Some parts of plant have medicinal value which contain chemical substances and they show some physiological activities on the human body (Hait *et al*., 2019).

- **Leaves:** It contains alkaloids, flavonaoids, tannins, saponins, carbohydrates, phytosterols, glycosides, proteins and anthequinones (Goyal *et al*., 2019).
- **Stem:** It contains carbohydrates, alkaloids, glycosides, flavonoids, terpenoids, steroids, phenols and saponins (Ahmad and Kabir, 2015).
- **Flower:** It contains alkaloids, cardiac glycosides, carbohydrates, flavonoids, phenols, proteins, saponins, tannins, terpenoids and quinones (Hait *et al*., 2019).

Isolated Compounds:

- **Leaves:** Leaves contains glucoside, Kino-oil contain oleic and lignoceric acid, linoleic acid and palmitic (Nadkarni, 2002) Kino-oil containing palmitic, oleic, lignoceric acid, linoleic acid and (Indurwade *et al*., 2019).
- **Flower:** Flowers has a butrin, butein, butin, isobutin, coreoopsin, monospermoside and their isoderivatives and sulphurein, palastrin (Mishra, 2016). Triterpene, varoius flavonoids butein, butin, isobutrin, coreopsin, isocoreopsin, sulphurein, monospermosideand, isomonospermoside (More *et al*., 2012), chalcones, aurones, isobutyine (Tiwari *et al*., 2019), palasitrin, 3',4',7- trihydroxyflavone. Myricyl alcohol, phenylalanine, stearic, aspartic acid, palmitic, lignoceric acids, arachidic, glucose, fructose, alanine and histidine (Sindhia and Bairwa, 2010).
- **Seed:** Oil is a yellow and tasteless in nature, proteolytic, plant proteinase, nitrogenous acidic compound, palasonin, lypolytic enzymes and polypeptidase (Similar to yeast tripsin). It also contains monospermoside (butein3-e-D-glucoside) and somonospermoside. Allophanic acid, several flavonoids 4-tetrahydroxy-8-methoxyisoflavone 6-O-rhamnopyranoside. Butin α-Amyrin, β-sitosterol-β-D-glucoside, sucrose, Fatty acids such as myristic, palmitic, stearic, arachidic, behenic, lignoceric, oleic, linoleic and linolenic, Monospermin andacid imide. 15- Hydroxypentacosanoic acid nheneicosanoic acid δ-lactone. 10, 16-dihydroxyhexadecanoic acid, Phosphatidylcholine, phosphatidylethanolamine and phosphatidylinositol (Sindhia and Bairwa, 2010).
- **Stem:** 3-Z-hydroxyeuph-25-ene and 2, 14-dihydroxy-11, 12-dimethyl-8- oxo-octadec-11- enylcyclohexane (Guha et al., 1990), stigmasterol-e-Dglucopyranoside and nonacosanoic acid (Mishra *et al*., 2000).
- **Bark:** Contain kino-tannic acid, gallic acid and pyrocatechin (Nadkarni, 2002). The plant also contains palasitrin, and major glycosides as butrin, alanind, allophanic acid, butolic acid, cyanidin, histidine, lupenone, lupeol, medicarpin, miroestrol, palasimide and shellolic acid (More *et al*., 2012).
- Gum: Tannins, mucilaginous material, pyrocatechin (Sindhia and Bairwa, 2010).
- **Root:** The root of *Butea monosperma* contains glucose, glycine, a glycoside (aglycon) and an aromatic hydroxy compound (Tandon and Tiwari, 1969).
- **Resin:** Jalaric esters I and III of the laccijalaric esters Acid has been extracted and identified from seed coats. Zamyrin, e-sitosterone, its glucoside, and sucrose; lactone-nheneicosanoic acid-delta-lactone (Yadav *et al*., 2020).

Table 2: Phytochemicals present in *B. monosperma* leaf ethanol, methanol and aqueous extracts (Goyal *et al*., 2019).

Phytochemical Name	Ethanol Extract	Methanol Extract	Aqueous Extract
Alkaloids	+	-	+
Flavonoids	+	+	+
Tannins	+	+	+
Saponins	+	+	+
Carbohydrats	+	+	+
Phytosterols	-	+	-
Glycosides	+	+	-
Protein	-	+	-
Reducing sugars	-	-	-
Anthroquinones	+	-	+

(+) present; (-) absent

Table 3: Physicochemical parameters of the flower of *B.monosperma* (Babu *et al*., 2016).

Parameters	Results (% w/w)
Loss on drying at 1050C	4.39
Total ash value	5.82
Acid insoluble ash	1.07
Water insoluble ash	0.78
Water soluble extractive	22
Alcohol soluble extractive	14.21

Table 4: Phytochemical screening *of Butea monosperma* Stem (Ahmad& Kabir, 2015).

Phytochemical test	Reagent used (test performed)	Result
Carbohydrate	Molish's reagent	+
	Fehling's reagnt	+
Alkaloids	Hagger's reagent	-
	Wagner's reagent	-
	Mayer's reagent	+
	Draggendrof's reagent	+
	Tannic acid solution	-
Glycosides	$FeCl_3$ glycoside test	+
	Keller killiani's test	+
	Borntrager's test	-
Flavonoids	Lead acetate	+
	Alkali	+
	Conc. H_2SO4	+
	$FeCl_3$	+
Terpenoids	$CHCl_3$+ Conc. H_2SO4	+
	$CHCl_3$+Acetic anhydride	+
Steroids	Salkowski test	+
Phenols	$FeCl_3$	+
	Ammonia	-
	Lead acetate	+
Saponins	Foam test	+

(+) present; (-) absent

Table5: Phytochemial screening of *Butea monosperma* (Hait *et al*., 2019).

Phytochemical test	Reagent used (test performed)	Interence	Result
Alkaloids	Wagner's reagent	Reddish brown ppt	-
Carbohydrate	Molisch's test	Red/dull voilet colour	+
Cardiac gycosides	Keller kelliani's test	Brown ring	+
Flavonoids	Shinoda test	Red colour	+
Phenols	Ferric chloride test	Deep or black colour	-
Phlobataninns	Precipitate test	Red ppt	+
Amino acid & Proteins	Ninhydrin solution in acetone	Purple colour	-
Saponins	Foam test	Persistent foam	+
Sterols	Liebermann-Burchard test	Dark pink/Red colour	-
Tannins	Braymer's test	Blue/Greenish colour	-
Terpenoids	Salkowki's test	Reddish brown ppt	+
Quinones	Treatment with conc.HCl	Yellow colour ppt	-
Oxalates	Treatment with Ethanoic acid glacial	Greenish black colour	+

(+) present; (-) absent

Table 6: Phytochemial evaluation of flower of *Butea monosperma* (Hait *et al*., 2019).

Phytochemica/Solvent Extract	PE	CH	EA	AC	EtOH	MeOH	H_2O
Alkaloids	-	+	-	-	+	+	+
Cardiac Glycosides	-	+	-	+	+	+	-
Carbobhydrates	+	+	+	+	+	+	+
Flavonoids	-	+	-	+	+	+	-
Phenols	-	+	-	+	+	+	-
Phlobataninns	-	-	-	-	-	-	-
Proteins	-	+	-	-	+	+	-
Saponins	+	+	-	-	-	+	+
Sterols	-	-	-	-	-	-	-
Tannins	-	-	-	+	+	+	+
Terpenoids	-	+	+	+	+	+	-
Quinones	+	+	+	+	+	+	+
Oxalates	-	-	-	-	-	-	-

(+) present; (-) absent; (PE)petroleum ether; (CH)chloroform; (EA)ethyl acetate; (AC)acetone; (EtOH)ethyl alcohol; (MeOH)methyl alcohol.

Pharmacological Activity:

Table 7: Pharmacological activities of *Butea monosperma*.

Plant parts	Activities
Leaves	Anti-inflammatory activity, antioxidant activity, antidiabetic activity, filarial activity.
Flower	Antidiarrhoel activity, anticancer activity, anti-convulsant activity, antidiabetic activity, anti-inflammatory activity, free radical scaving activity, antitumour activity, anti-toxicity, hepatoprotective activity, antidopaminergic activity, antihepatoprotective activity, anti-inplantation activity, liver disorder activity.
Seed	Anti-inplantation activity, antihelmenthic activity, antihyperglycaemic activity, antiviral activity, antimicrobial activity, anti-inflammatory activity.
Stem and Bark	Antidiarrhoel activity, anti-inflammatory activity, anti-stress activity, antifungal activity, antiulcer activity, wound healing activity, osteogenic and osteoprotective activity, thyroid inhibitors and hypoglycaemic activity, anti-obessity.
Fruit	Hyperglycaemic activity, antidiabetic activity, antimicrobial and fungal activity, antihelmenthic activity.
Gum	Antimicrobial activity.

- **Leaves**

Anti-inflammatory and anti-oxidant activity:
The ethanol, petroleum ether, ethyl acetate, chloroform and hexane were estimated from *B. monosperma* leaves for anti-inflammatory activity by employing a technique for stabilising the membrane of human red blood cells (HRBC). The Significant anti-inflammatory effects are seen in the petroleum ether and chloroform extracts, but only mild anti-inflammatory effects are seen in the hexane, ethyl acetate, and ethanol extracts (Borkar *et al*., 2010). Moreover, these extracts show antioxidant effects (Tiwari *et al*., 2019)

Antidiabetic activity:
The ethanolic extract of *B. monosperma* leaves (BMEE) on alloxan induced diabetes model in male rats found that it is demonstrated that the leaves have hypoglycemic effects by the fact that BMEE lowers fasting blood glucose levels and boosts the action of antioxidant enzymes during treatment at a dose of 300 mg/kg for 45 days (Gupta *et al*., 2012).

Anti-filarial:
The extracts of *B. monosperma* leaves and roots with double distilled water followed by filtration and concentrated the residue by keeping in hot air oven. This extract has anti-filarial properties by inhibiting the movement of microfilariae at dependent concentrations in vitro with an IC_{50} value of 83ng/ml (Sahare *et al*., 2008).

- **Flowers**

Anti-diarrhoeal potential activity:
B. monosperma (Palash) is a source of flavonoid. It contains butein, butrin, isobutrin and plastron. The most serious and deadly symptoms are those related to digestive issues are characterised by increased faeces and stool production. The WHO established the diarrheal disease control programme (CDD) with the goal of eradicating this issue and also controlling it. This programme places a strong emphasis on prevention methods and integrates traditional medicine practises. Additionally present is ricinoleic acid, which alters the transfer of mucosal fluid and electrolytes and is the cause of diarrhea's hypersecretory activity. In comparison to other diarrhoeal medications, riboseoleic acid reduces the amount of water passed through the body and lessens the frequency of diarrhoea. People in urban settings are more likely to come in contact with this illness, especially in children which causes malnutrition. Due to this observation, UNESCO and WHO are now more interested in using herbs to treat diarrhoea (Yadav *et al*., 2020).

Anti-cancer activity:
The aqueous extract was evaluated from dried flowers of *B. monosperma* for the anticancer, pro-apoptotic, hepatoprotective, anti-proliferative, antioxidant, and anti-inflammatory properties. The cell multiplication and increase of cells in the G1 phase were noticed along with a large activation of apoptotic cell death which may indicate anti-cancer potential. The extract of oral administration in transgenic mice conferred hepatoprotection (Choedon *et al*., 2010).

Anticonvulsant activity:
According to research, the active ingredient in the petroleum ether extract of *B. monosperma* flowers that exhibits anticonvulsant activity is found in the portion of the extract that is soluble in acetone (Kasture *et al*., 2002). This portion shielded creatures from the most intense electric shocks, electrical jolts and mouse convulsions caused by pentylenetetrazole (Surin and Ananthaswamy, 2011). A triterpene whose name is TBM has been found in palash. TBM shows anticonvulsant activity against seizure induced by MES (Maximum Electro Shock), lithium sulphate, and pilocarpine nitrate, electrical killing, and pentylenetetrazol (PTZ). It also shows depressant effect on CNS after continuouse use of 7 days and after repeatedly using the TBM duration of sleep induced by pentobarbital was not decreased (Pawar *et al*., 2019).

Antidiabetic activity:
The ethanolic extract of *B. monosperma* flower has a antidiabetic activities against alloxan-induced diabetic Wistar rats (Somani *et al*., 2006). The daily treatment of alloxan instigate diabetic animals with 50% ethanolic extract of *B. monosperma* flowers (BMEE) for continuously 45 days decreased the blood glucose level therefore, preventing steep onset of hyperglycemia which was inspected after alloxan administration and maintained body weight and value of blood glucose level observed in normal control andglibenclamide-treated diabetic mice. The level of serum (cholesterol) triglyceride, low-density lipoprotein and very low-density lipoprotein cholesterol were also decreased the antidiabetic potential of BMEE. The phytochemical analysis of the ethanolic extract proved the presence of flavonoids, saponins and sterols which are potent antihyperglycemic and anti-oxidative agents (Neelam *et al*., 2017).

Anti-inflammatory and anti-oxidant activity:
The molecular mechanism of anti-inflammatory activity in mast cell has inspected and isolated different polyphenols like butrin, isobutrin, isocoreospin and butein from flowers of *B. monosperma* by preventing NF-kappa B from activating (Rasheed *et al*., 2010). Breast cancer cells MCF-10A and MCF-7 express COX-2 when PMA is added, and the overall activity of PKC reveals butein's anti-inflammatory and anti-cancer properties (Lau *et al*., 2010). The quantified and prepared aqueous extract of flowers by soxhlet, decoction, ultrasonic and maceration methods show the anti-oxidant activity (Jarald *et al*., 2009).

Liver disorder activity:
The floral extract from *Butea monosperma* is beneficial for liver diseases. The extract has been tested for the antihepatotoxic, flavonoids, butrin and isobutrin. The results of pretreating methanolic *B. monosperma* at two doses before to TAA treatment may help with the chemotherapy preventative effect. The detoxifying enzyme system and isolated amounts of other xanthine oxidase, QR, GPx and SOD which are the key phase II enzymes that were reduced in B. monosperma and the level of glutathione and its metabolising enzyme in the liver significantly recovered (Sindhia and Bairwa, 2010).

Radical scavenging activity:
The methanolic extract of flowers in ethyl acetate, butanol and the aqueous fraction possesses the ability to scavenge free radicals (Lau *et al*., 2010). Ethyl acetate, aqueous fraction and butanol were derived from methanol extract from flowers of *butea monosperma* (Tiwari *et al*., 2019). A significant number of free radicals were scavenged by the methanol extract, ethyl acetate, butanol fractions and aqueous fraction was found without any radical scavenging properties. Because the extracts had higher phenolic content of 17.74% w/w in the methanol extract, ethyl acetate and butanol fractions, respectively may be seen (Pawar *et al*., 2019).

Antimycobacterial and antimicrobial activity:
The various bioactive flavonoids from *B. monosperma* flowers, including dihydrochalcone and dihydromonospermoside, have antimycobacterial activity when combined with buteinmonospermoside and isoliquiritigenin (Chokchaisiri *et al*., 2009). Antimicrobial activity of *B. monosperma* flowers are effective against Pseudomonas aeruginosa, Bacillus cereus and Staphylococcus aureus (Vasu *et al*., 2010).

Antitumor activity:
The flowers of *butea monosperma* was aqueous extracted by demonstrating experiments of liver architecture and nuclear morphometry of the x-15-myconco animals were preserved and the serum VGEF levels were also downregulated, demonstrating antitumorigenic efficacy. This proliferation signal has disappeared from the tumour tissue after therapy, according to immunohistochemical labelling of a liver segment with an anti-ribosomal protein S27a antibody (Pawar *et al*., 2019).

Toxicity:
The extraction of dry flower powder with hot petroleum ether yields about 2.2% of hot petroleum ether extract (BPEE) and 9.2% of hot methanol extract (BME). This *butea monosperma* flower extracts (BPEE and BME) can be pharmacological studies. Adult Winstar albino rats (100-130gm) and Swiss Albino mice (20-30gm) of either sex was used as experimental animals. Limit test revealed that oral LD_{50} of BPEE and BME was above 2000 mg/kg body weight and hence it can be useful for the animals up to oral dose of 2000 mg/kg body weight (Pawar *et al*., 2019).

Hepatoprotective activity:
When powdered of *butea monosperma* flower was provided to rabbits then paracetamol was introduced and serum marker enzymes got inhibited. In the treatment of paracetamol, the alanine phosphatase and alkaline transaminase increased. Butrin and sobutrin acted as hepatoprotective agent (Pawar *et al*., 2019).

Antidopaminergic activity:
The antidopaminergic activity of methanolic was extracted from *B. monosperma* flowers. Antidopaminergic activity is present in form of isoflavone whichextractedfrom ethyl acetate soluble fraction of methanolic acid and it isolated and added to foot shock-induced aggressiveness in rats and potentiated the catalepsy caused by haloperidol in a dose-dependent manner (Velis *et al*., 2008).

Antihepatoprotective activity:
The isobutrin and butrin obtained from *B. monosperma*

flowers which has a antihepatotoxic properties against CCl_4 for acute liver injury in rats (Sharma and Shukla, 2010). The aqueous extract restored the CCl_4 and introduced alteration in serum transaminases, protein, albumin, hepatic lipid peroxidation which decreased the glutathione and control total level of protein (Surin and Ananthaswamy, 2011).

Anti- Implantation activity:
The flowers of palash contain butin and it extracted value has a contraceptive activity in both male and female which proves that the anti-implantation activity is present (Pawar *et al*., 2019).

- **Seeds**

Anti- Implantation activity:
The seeds of *butea monosperm* (palash) extracted and found that it contains butin which was provided to female rats at 5, 10 and 20 mg/rat doses from day 1-5 of pregnancy and it results inanti-implantation activity at 40%, 70%and 90% of introduced animals. Alcoholic extract of palash shows the anti-fertility activity. Butin is a weak estrogen as sufficient uterotrophic and effect was observed even at 1/20th of contraceptive dose (Pawar *et al*., 2019).

Antihelmenthic activity:
Antihelminthic activity of methanolic isolated from the seeds of *B. monosperma* and found that the antihelminthic activities are effective against Trichostrongylid nematodes in sheep. It was discovered that the sheep had an infection brought on by the stomach worm *Ascardiagalli*. The sixteen different kinds of carbon lactone compounds were isolated from seeds. An important medication for worm infections, Palasonin which is effective against *Ascaris lumbricoids* and *Fasciola hepatica*, was discovered to have anti-helminthic properties and another chemical ingredient. Palasonin's primary method of action is to prevent the uptake of glucose and poke at the glycogen stores, which slow down the parasite's ability to produce energy and cause parasite death (Yadav *et al*., 2020).

Anti-hyperglycemic activity:
The treatment of erhanolicsoxhlet up to 4-5 weeks carried out which resulted in an antihyperglycemic effect when given orally to sheep with mixed species of gastrointestinal nematodes at 1, 2 and 3 g/kg and shows glucose tolerance in non-insulin dependent diabetes mellitus (NIDDM) in rats (Bavarva and Narasimhacharya, 2008).

Antiviral activity:
The seeds of *B. monosperma* shows antiviral activity by extracting a potential antiviral flavone glycoside (Yadava and Tiwari, 2005).

Antimicrobial activity:
The *B. monosperma* seeds are used to make the oil, which has a powerful bactericidal and fungicidal activity in vitro (Mehta *et al*., 1983).

Anti-inflammatory activity:
The unsaponified material, mixed acids, and fixed oil that were separated from *B. monosperma* plant seeds all had anti-inflammatory properties. These activities are effective against the granuloma that cotton pellets and carrageenin cause in rats' paws (Gunakunru *et al*., 2004).

- **Stem and Bark**

Anti diarrhoel activity:
The ethonolic isolated from the stem bark of *B. monosperma* (Palash) and it shows the anti-diarrhoel activities against castor oil results in diarrhea and PGE_2 to decrease the enteropoolong in rats with reduction of gastrointestinal motility after charcoal meal administration (Gunakkunru *et al*., 2005).

Anti-inflammatory:
The *B. monosperma*'s stem or bark can be used to make methanol, which has anti-inflammatory properties (More *et al*., 2012) and analgesic properties for carrageenin-induced paw edoema and acetic acid-induced writhing, and for the hot plate test model, pentozocine, at continuous doses that are comparable to conventional medication named diclofenac sodium (William and Mohan, 2007).

Anti-stress:
The water-soluble component of ethanolic extricate has an anti-stress properties. The extract decreased the tension that comes with being submerged in water, which raises levels of brain serotonin and plasma corticosterone. This anti-stress impact was comparable to that of zolpidem (More *et al*., 2012).

Anti-fungal activity:
The petroleum and ethyl acetate isolated from bark of *B. monosperma* which results in stronger antifungal action against *cladosporium* or *cladosporioides* than the common fungicide Benlate (Bandara *et al*., 1989).

Anti-ulcer activity:
The methanolic was isolated from the stem or bark of *B. monosperma* which has an anti-ulcer activity. By using the extract's free radical scavenging properties for its anti-ulcer impact, it was discovered that at 500 mg/kg, aspirin and ethanol influence gastric ulcerations could be reversed by 79.30 and 82.20%, respectively (Patil *et al*., 2009).

Wound healing activity:
The ethanol isolated from *B. monosperma* bark shows wound-healing properties in animals (Gavimath *et al*., 2009). When applied topically to complete excision incisions produced on rats' backs, it altered the wound healing effect. By increasing the DNA, total protein, and total collagen content in granulation tissues, ethanol stimulates cellular proliferation and collagen synthesis at the site of the wound (Sumitra *et al.*, 2005). It was found that the extract, which has wound-healing properties, increased wound contraction and decreased epithelialization time in an excision wound model. It also increased the tensile strength of the incision wound, granulation tissue weight, and hydroxyproline content in the dead space wounds when compared to the control group (Gavimath *et al*., 2009). Rats with excision wounds that include flavonoids have better wound contraction and shorter epithelization times (Ahire *et al*., 2020).

Osteogenic and osteoprotective activity:
The stem and bark of *B. monosperma* extracted and it has

two different structures of methoxy isoflavones i.e., cajanin and isoformononetin. In which the cijanin shows strong mitogenic nd different promoting effect on osteoblasts. As a result, isoformononetin exhibits strong anti-apoptotic effects and promotes the development of various osteoblasts (Bhargavan *et al.*, 2009). Three novel compounds, buteaspermin A, B and buteasperminol as well as several well-known compounds are present in the phytochemicals of *B. monosperma*'s stem and bark (Maurya *et al*., 2009). The osteogenic and osteoprotective potential isolated and standardized the fraction from stem bark of *B. monosperma* (Pandey *et al*., 2010).

Thyroid inhibitors and Hypoglycemia:
The stigmasterol (2.6 mg/kg) isolated from the bark of *B. monosperma* was administered to test animals for 20 days and they observed decresed in serum triiodothyronine, thyroxin and glucose concentrations with increase in insulin. Hepatic lipid peroxidation was reduced even more, while catalase, superoxide dismutase, and glutathione activity were all increased to cure thyroid inhibitory and hypoglycemic effects of stigmasterol (Panda *et al*., 2009).

Anti-obesity activity:
Bark from *Butea Monosperma* showed an anti-obesity effect by decreasing the body weight in cafeteria and atherogenic diets fed of rats which proves that *the B. monosperma* shows weight decreasing property (Ahire *et al*., 2020).

- **Fruits**

Antidiabetic activity:
The hypoglycemic and hypolipidemic activity of *B. monosperma* in normal and diabetic humans shows the antidiabetic effect (Akhtar *et al*., 2010). For the herbal formulation the three types of plants that are Piper betel, *Butea monosperma* and *Trigonella foenum graecum* was experimented for their anti-diabetic potential in normal and alloxan diabetic rats it results shows the antidiabetic potential (More *et al*., 2012).

Antihelminthic activity:
The antihelminthic activity of *B.monosperma* is useful in herbal formulation (Akhtar *et al*., 2010). The *B. monosperma* contains Pippalirasayana which is used in treatment of chronic dysentery and worm infestations. The Pippalirasayana isolated for anti-giardial and *Giardia lamblia* trophozoite-infected mice have immunostimulatory activity which indicates 98% recovery from infection after 15 days of treatment (Agarwal *et al*., 1994). It is observed that after 15 days treating with drugs there was *no Giardia lamblia* (trophozoites/cysts) from stools of 23 out of 25 patients (More *et al*., 2012).

Antimicrobial and fungal activity:
The various fractions carried out from *B. monosperma* possess which has an antimicrobial effects across different bacterial and fungal species (Gurav *et al*., 2008).

Hypoglycemic activity:
The hypoglycemic activity powder was made from *B. monosperma* fruits in normal and diabetic human volunteers who were suffering from diabetes type II (non-insulin-dependent diabetes mellitus- NIDDM). After treatment (3g/30ml of water for 30 days) it was noted that the levels of plasma glycoprotein, urine, sugar and blood glucose all fell. Possible anti-diabetic actions of B. monosperma fruit extract was observed by a decrease in lipid profile and a restoration of liver enzyme activity (Naeem and Khan, 2010).

- **Gum**

Antimicrobial activity:
Gum of *B. monosperma* is useful in microbial infection. In order to test the alcohol's in-vitro antibacterial properties the gum from *Butea monosperma* was extracted. The disc diffusion method was used to conduct the experiment against various microbial strains including *Staphylococcus aureus, Bacillus subtilis, Pseudomonas aeruginosa,* and *Candida albicans* (Ahire *et al*., 2020).

Conclusion:
Phytochemical play's important role in preventing the various diseases and causes. Some parts of plant have medicinal value which contain chemical substances and they show some physiological activities on the human body. Many phytochemicals have been extracted from different extracts of various parts of this plant like leaves, stem, flower, fruit, seed etc. which shows the presence of alkaloids, phenol, saponins, glycosides, carbohydrates, tannins, flavonoids, steroids and titerpenoids etc. Some part of the plant has a wide range of pharmacological activities such as antidiarrhoel activity, anticancer activity, anticonvulsant activity, antidiabetic activity, free radical scaving activity, antitumour activity, anti-toxicity activity, hepatoprotective activity, antidopaminergic activity, antihepatoprotective activity, anti-inplantation activity, liver disorder activity,anti-inflammatory activity, anti-oxidant activity, antidiabetic activity, filarial activity,anti-inplantation activity, antihelmenthic activity, antihyperglycaemic activity, antiviral activity, antimicrobial activity, anti-inflammatory activity,antidiarrhoel activity, anti-inflammatory activity, anti-stress activity, antifungal activity, antiulcer activity, wound healing activity, osteogenic activity, thyroid inhibitors & hypoglycaemic activity, anti-obessity activity,hyperglycaemic activity, antidiabetic activity, antifungal activity, antihelmenthic and antimicrobial activity.

Future Prospects:
B.monosperma has got many activities. The maximum activity is reported in flowers compare to stem, bark, leaves, seed, fruit and gum. Minimum activity is observed in gum compared to other parts of the plant. It has not exploited for the other different activities like antimalarial, antihelmintic, wound healing, antiarthiritic, gastroprotective activity so we can.

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