

A Review on *Butea monosperma* (Lam.) kuntze: A Great Therapeutic Valuable Leguminous Plant

Divya fageria, Dr. D.V. Rao

Biotechnology lab, lab no.5 , Department of Botany , University of Rajasthan, Jaipur

Abstract- *Butea monosperma* (Lam.) kuntze [Family: leguminosae] is a medium-sized deciduous tree popularly known as Flame of forest, Dhak or palas in Hindi, Bastard Teak in English, Parasa in Tamil which is widely distributed throughout India, Burma and Ceylon The family fabaceae comprises of 630 genera and 18000 species. It is adaptable tree for sub-tropical regions which requires alkaline, swampy badly drained soils and a sunny location. It grows easily from seed. It finds use both medicinally and commercially with each part of the plant having utility. Extract of the plant possess significant astringent , aphrodisiac, anti-helminthic, anti-inflammatory anti- bacterial , anti-fungal , anti-diabetic and anti -asthmatic properties. This article briefly reviews the botany, distribution, ecology, uses of the plant, chemical composition , pharmacological activities of the plant and its constituents .This is an attempt to compile and document information on different aspect of *Butea monosperma* (Lam) Kuntze and its potential uses.

Index Terms- *Butea monosperma* (Lam.) kuntze, Dhak, Palas, Flame of forest, Astringent, Aphrodisiac, Anti-asthmatic, Anti-helminthic, Chemical composition.

I. INTRODUCTION

From the time immemorial, plants have been widely used as curative agents for variety of ailments. Concentrated flowers or seeds extract can be found in various herbal preparations which are widely available in market today .Herbs have always been the principal form of medicine in India and presently they are becoming popular through the world,as people strive to stay healthy in the face of chronic stress and pollution, and to treat illness with medicines that work in count with the body's own defence .There is a widespread belief that green medicines are healthier and more harmless or safer than synthetic ones. In traditional medicine , there are many natural crude drugs that have the potential to treat many disease and disorders . *Butea monosperma* (palas) is a medium-sized deciduous tree belongs to family fabaceae and sub- family papilionaceae. This tree is also called 'Flame of the Forest' and Bastard Teak (Kirtikar and Basu, 1935) .They comprise one of the largest families of flowering plants numbering 630 genera and 18000 species (The wealth of India, 1988) . It grows through the Indian subcontinent especially in Indo-Gangetic Plains (Chopra et al., 1958). It is said that the tree is a form of Agnidev,'God of Fire'. This tree grows up to 50 ft high ,with clusters of flowers. Flowers are offered in place of blood in sacrifice rituals to goddess Kali (Ambasta, 1994). The genus *Butea* includes *Butea monosperma*, *Butea parviflora*,*Butea minor* and *Butea superba* widely distributed

through India. It is one of the most beautiful tree has been put to some useful purpose. All parts of plant have been used as crude drug for the treatment of tumors, piles, skin diseases, wounds and ulcers (Mengi and Deshpande,1995). *Butea monosperma* is extensively used in Ayurveda , Unani and Homeopathic medicine and has become a treasure of modern medicine.The plants of this genus are well known for their colouring matters.Commonly *Butea monosperma* is used as tonic, astringent ,aphrodisiac and diuretics .(Nadkarni ,2002). The flowers are widely used in treatment of hepatic disorder, viral hepatitis, diarrhea ,depurative and tonic.The flowers are also good source of flavonoids. The contents of flowers are Butein, Butrin, Isobutrin ,Plastron ,coreipsin and isocoreipsin .Isolation of mediacarpin with antifungal activity from this part of plant has also been reported .The Euphane triterpenoid 3a-hydroxyeuph-25-ene and the alcohol 2,14-dihydroxy-11,12-dimethyl-8-oxo-octadec-11-enylcyclohexane has also been isolated from the stem (Mishra et al., 2000).The Imide palasimide has been isolated from the pods of this plant species. Studies on anti-oxidant status following ulceration indicate that free radicals seem to be associated with the pylorus ligation and ethanol induced ulceration in rats .The traditional system of medicine claims that the plant is a rejuvenator.Owing to its versatile characteristics, this plant is a multipurpose tree with immense medicinal and economical value.

A. Botanical Classification

Kingdom : Plantae
Division : Magnoliophyta
Class : Magnoliopsida
Order : Fabales
Family : Fabaceae
Genus : *Butea*
Species : *monosperma*

B. Botanical Name

Butea monosperma (Lam.) kuntze

C. Common Names

According to Kirtikar and Basu (1935) all the common names of this plant are listed .

Sanskrit : Palasah
Hindi : Dhak, Palas, Chalcha
English : Bastard Teak, Parrot Tree
Bengali : Palas, Polashi
Marathi : Kakracha
Gujarati : Khakharo
Tamil : Parasa

II. DOCUMENTED SPECIES DISTRIBUTION

A. Native

Tropical South Asia, especially from the region of Pakistan, India (Indo-Gangetic plains), Vietnam, Malaysia, Western Indonesia, Laos, Cambodia, Bangladesh, Nepal, Sri-Lanka, Manmar, Thailand.

B. Occurrence

It is common throughout the greater part of India, Burma and Ceylon extending in the north west Himalayas up to 1000 m, and higher in the outer Himalaya, Khandesh Akranj up to 1200m and Hill of South India up to 1300 m. (Chopra, 1991). It is especially found in Maharashtra (Kolhapur) Karnataka (Chikmagalur, Coorg, Mysore, Shimoga, S.Kanara) Kerala: Alapuzha, Idukki, Kasaragod, Kollam, Kozhikode, Malapuram, Palakkad. Rajasthan: Jaipur, Udaipur, Kota in throughout India, except Jammu & Kashmir, Himachal Pradesh, Sikkim, Arunachal Pradesh, Assam, Nagaland, Meghalaya, Manipur, Tripur, Mizoram.

C. Butea species

The plant belongs to family Fabaceae which is widely distributed in throughout the world. Below mentioned species were recorded. *Butea acuminata*, *Butea affinis*, *Butea africana*, *Butea apoensis*, *Butea balansae*, *Butea braamiana*, *Butea bracteolata*, *Butea cuneiformis*, *Butea crassifolia*, *Butea dubia*, *Butea ferruginous*, *Butea gyrocarpa*, *Butea harmandii*, *Butea laotica*, *Butea listeria*, *Butea littoralis*, *Butea loureirii*, *Butea*

parviflora, *Butea pulchra*, *Butea purpurea*, *Butea minor*, *Butea macroptera*, *Butea maingayi*, *Butea merguensis*, *Butea rosea*, *Butea riparia*, *Butea suberecta*, *Butea superba*, *Butea oblongifolia*, *Butea varians*, *Butea volubilis*.

III. ECOLOGY

Native to sub tropical environments, it is capable of growing in waterlogged situation, black cotton soil, saline, alkaline, swampy badly drained soils and on barren land except in arid region. This species grows to elevations of 1200m. It regenerates naturally and easily in mixed deciduous stands in temperate forests. Natural reproduction is profuse by seed.

IV. MYTHOLOGICAL HISTORY

It is believed that the tree is a form of Agni Dev, God of fire. It was a punishment given to him by Goddess Parvati for disturbing her and Lord Shiva's privacy (Murti et al., 1940).

V. BOTANICAL DESCRIPTION

Butea monosperma is an erect medium sized dry season-deciduous tree, growing to 15m tall. All the botanical descriptive characters of this plant are listed in Table 1.

Table 1. Botanical Description of *Butea monosperma*

Plant type	Medium sized, deciduous tree (figure A) Height:- 40 to 50 feet Growth rate:- Moderate Texture:- Medium Chromosome number:- 22
Growing requirements	Light requirement:- Tree grows in full sun Soil tolerance:- Black cotton soil, saline, alkaline, water logged situation Drought tolerance:- High Aerosol salt tolerance:- Moderate
(a) Leaf	Compound with three leaflets, obliquely ovate and broadly elliptic. The size varies from 15 cm to 20 cm by 10 cm x 15 cm. The leaves fall off by December and reappear during. (figure B)
(b) Flower	The size is nearly 2 to 4 cm in diameter. The flowers form a gorgeous canopy on the upper portion of the tree, wears a kind of exquisite orange and red colour. Flowers start appearing in February and stay on the end of April. (figure C)
(c) Fruit	Flat legumes, pods are stalked 12.5-20 by 2.5-5cm, thickened at the sutures. Young pods have a lot of hair, a velvety cover. (figure D)
(d) Seed	Flat 25 to 40 mm long, 15 to 25 mm wide and 1.5 to 2 mm thick. The seed-coat is reddish-brown in colour, wrinkled and two large yellowish cotyledons. (figure E)
(e) Root	Taproot is thick and long, lateral roots are numerous and well-developed (figure F)
(f) Bark	Fibrous and bluish-gray to light brown in color. When injured, it exudes a kind of red juice known as 'Butea gum' or 'Bengal kino'. (figure G)



Figure A : Healthy *Butea monosperma* plant



Figure B :Leaf



Figure C : Flower



Figure D: Pods



Figure E: Seeds



Figure F: Root



Figure G : Bark

VI. GROWTH PATTERN

Growth is seen best from sea level to an altitude of 1200m and optimal rainfall of 500 to 2500mm. It sheds its leaves in Dec. and develops new leaves from March onwards. Flowers appear in February to end of the April (Cowen, 1984). Seed ripens from February to May as shown in Table 2.

Table 2. General growth pattern of *Butea monosperma*

Months Plant parts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Seed ripen												
Pods ripen												
Flowers												
Fruits												
Leaf fall												
New leaf												

VII. NUTRITIVE EVALUATION

Leaf extract of *Butea monosperma* contain nutritive value (Ramana et al., 2000) as shown in Table.

OM	-	889.2
CP	-	150.2
NDF	-	506.1
ADF	-	356.0
Cellulose	-	151.2
Hemicellulose	-	150.2
Lignin	-	130.7
Total phenolics	-	6.5
Condensed Tannins-		20.8

OM =Organic matter ADF=Acid detergent fibre
CP = Crude protein NDF=Neutral detergent fibre

VIII. CHEMICAL CONSTITUENTS

Table 3. Chemical Constituents in *Butea monosperma*

Flower	Triterpene (Mishra et al., 2000) . Several flavonoids butein , butin , isobutrin , coreopsin, isocoreopsin (butin 7-glucoside) , sulphurein , monospermoside (butein 3 –e-D-glucoside) and isomonospermoside , chalcones , aurones, isobutyine, palasitrin, 3',4',7-trihydroxy flavones (Gupta et al.,1970) , myricyl alcohol , stearic,palmitic, arachidic and lignoceric acids (Murti et al.,1940) glucose, fructose, histidine, aspartic acid, alaine and phenylalanine (Shah et al.,1992).
Seed	Oil (yellow,tasteless proteolytic and lypolytic enzymes,protein proteinase and polypeptidase
Root	Glucose, glycine, a glycoside (aglycon) and an aromatic hydroxy compound (Tandon et al.,1969).
Stem	3-Z- hydroxyeuph-25-ene and 2,14- dihydroxy-11,12-dimethyl-8-oxo-octadec-11-enylcyclohexan (Guha et al.1990) stigmasterol-e-D-glucopyranoside and nonacosanoic acid (Mishra et al., 2000).
Bark	Kino-tannic acid, Gallic acid, pyrocatechin (Nadkarni , 2002). Also contains palastrin,and major glycosides as butrin,alanind, allophanic acid, butolic acid, cyaniding, histidine , lupenone, lupeol , (-)- medicarpin, miroestrol, palasimide and shelloic acid (4,5,3,4,16,17,18,19,20), Two compounds 3,9-

	dimethoxypterocarpan and triterpenoid ester , 3-hydroxyeuph-25-enyl heptacosanoate (Shukla et al.,2002).
Leaves	Glucoside, kino-oil containing oleic and linoleic, palmitic and lignoceric acid (Murti et al.,1940).
Resin	Jalaric esters , laccijalaric esters, Z-amyrin, e-sitosterone and its glucoside, sucrose, lactone-nheneicosanoic acid (Rastogi and Mehrotra,1979;Singh et al.,1974).

IX. ECONOMICAL AND MEDICINAL VALUE

The plant *Butea monosperma* has immense medicinal and economical values which are tabulated in Table 4.

Table 4. Economic and Medicinal importance of *Butea monosperma*

Root	
Economic value	- Roots are used as an antidote.(Jain , 1991).
Medicinal value	- It is useful in filariasis and night blindness (Mengi and Deshpande, 1995). - Roots are bitter,antihelminthic. It also causes temporary sterility in women. (The wealth of india,1988).
Stem	
Economic value	- Wood is used for well curbs and water scoop (Ambasta,1994). - It is a cheap board wood.(Ambasta,1994). - Wood pulp is suitable for newsprint manufacturing (Ambasta,1994). - It is also a host to the Lac insect,which produces natural lacquer (Sequeira and Bezkorowajnyj, 1998). - The dry stem pieces are used to make sacred fire.(The wealth of India, 1988).
Medicinal value	- It is useful indigenous medicine for the treatment of dyspepsia and sore throat. (The wealth of India,1988).
Leaf	
Economic value	- Used as cattle fodder. (The wealth of India ,1988). - Used as making platters, cups and bowls (The wealth of India, 1988). - It is used for wrapping tobacco to make biddies (The wealth of of India, 1988). - It is also used as packing material for parcels.
Medicinal value	- It promotes diuresis and menstrual flow. (Kirtikar and Basu, 1935;Kala, 2004).
Seed	
Economic value	- Seed are pounded with lemon juice and applied to the skin that act as rubefacient (kirtikar and Basu, 1935; Boutelje,1980).
Medicinal value	- It is used as remedy against intestinal worms (kirtikar and Basu, 1935; Boutelje, 1980). - It is used inflammation,bleeding piles,urinary stones and eye disease. (kirtikar and Basu, 1935; Boutelje, 1980).
Flower	
Economic value	- The flower yeild an orange dye.It is used to prepare traditional Holi colour.
Medicinal value	- It is used as tonic to cure skin disease, gout and burn sensation.(Kirtikar and Basu,1935; Kala, 2004). - It is also used in astringent diarrhoea and diuretic (Bhalla and Walter, 1999).

Bark	
Economic value	- Bark fibres are used for making cordage (Kirtikar and Basu, 1935).
Medicinal value	- The stem bark is used for the treatment dyspepsia,diarrhoea and dysentery(Kirtikar and Basu ,1935;Kala ,2004). - It is also used for the cure of ulcer, sore thorat and snake bite.
Gum	
Economic value	- It is known as Bengal Kino.it is used in certain food dishes. - Used for caulking boats as well.
Medicinal value	- The gum is used in stomatitis, ringworm, septic sore throat. - It is used for the treatment of leucorrhoea ,excessive perspiration and diarrhoea (Kirtikar and Basu, 1935; Boutelje, 1980).

X. PHARMACOLOGICAL ACTIVITIES

A. Antifungal activity, Antimicrobial activity and Antibacterial activity

The stem bark of *Butea monosperma* displays antifungal activity which is due to the presence of an active constituent (-)-medicarpin (Bandara et al.).The seed oil of *Butea monosperma* shows significant bactericidal and fungicidal effect in in-vitro testing (Mehta and Bokadia, 1981).

B.Anti-inflammatory activity

The leaves of *Butea monosperma* exhibit ocular anti-inflammatory activity in rabbits (Mengi and Deshpande , 1995).The anti-inflammatory activity of methanolic extract of *Butea monosperma* evaluated by carrageenan induced paw edema at 600 and 800 mg/kg inhibition of paw edema by 26 and 35% in cotton pellet granuloma inhibition of granuloma tissue formation by 22 and 28% (Shahavi and Desai, 2008).

C. Anticonvulsive activity

It shows anticonvulsive activity due to the presence of a triterpene. (Kasture et al.,2002).The ethanolic extracts of leaves of *Albizia lebbeck* and flowers of *Hibiscus rosa sinensis* and the petroleum ether extract of flowers of *Butea monosperma* exhibited anticonvulsant activity.The acetone soluble part of petroleum ether extract of *Butea monosperma* flowers showed anticonvulsant activity.The fractions protected animals from maximum electroshock electrical kindling pentylenetetrazole and lithium-pilocarpine induced convulsion but failed to protect animals from strychnine-induced convulsions.The fractions raised brain contents of gamma-aminobutyric acid (GABA) and serotonin (Kasture et al., 2000).

D. Anti-esterogenic and anti-fertility activity

Alcoholic extract of flowers of *Butea monosperma* has also been reported to exhibit antiestrogenic (Shah et al., 1990). Hot alcoholic extract of *Butea monosperma* seeds have been reported for significant anti ovulatory and anti-implantation activities

when given to rats and rabbits.The active constituent has been identified as butin (Bhargava , 1986). Butin also exhibits male contraceptive properties (Dixit et al., 1981). Antifertility effect of seed extract of *Butea frondosa* has also been reported in mice (Razdan et al., 1970). The stem bark of *Butea monosperma* led to the isolation and identification of three new compounds named buteaspermin A, buteaspermin B and buteaspermanol along with 19 known compounds (Maurya et al., 2009).

E. Anti-diabetic activity

The single dose treatment of ethanolic extract of *Butea monosperma* flowers at the dose of 200mg/kg P.O significantly improved glucose tolerance and cause reduction in blood glucose level in alloxan induced diabetic rats.(Somani et al., 2006). Oral administration of the ethanolic extract of the *Butea monosperma* seeds at the dose of 300mg/kg b.w.,exhibited significant antidiabetic,hypolipaemic and antiperoxidative effects in non-insulin dependent diabetes mellitus rats.

F. Anti-diarrhoeal activity

Butea monosperma gum has also been found useful in cases of chronic diarrhoea.It is a powerful astringent and also decrease bilirubin level.(Ramana et al., 2000).The ethanolic extract of stem bark of *Butea monosperma* at 400 mg/kg and 800 mg/kg inhibited castor oil induced diarrhoea due to inhibiting gastro-intestinal motility and PGE2 induced enteropooling.It is used as nonspecific anti diarrhoeal agent in folk medicine .(Gunakkunru et al, .2005).

G.Free radical scavenging

Free radical scavenging activity of various extracts of flowers evaluated by using different in- vitro models like reducing power assay, scavenging of 2,2 diphenyl-1-picrylhydrazyl (DPPH) radical, nitric oxide radical, superoxide anion radical, hydroxyl radical and inhibition of erythrocytes hemolysis using 2,2' azo-bis (amid inopropane) dihydrochloride (AAPH). Methanolic extract along with its ethyl acetate and butanol fractions showed potent free radical scavenging activity.The observed activity could be due to higher phenolic contents in the extract (Schoeller et al., 1938).

H. Anti helminthic activity

The seeds of the plant are used in Ayurvedic system as an anthelmintic drug. (Katti and Manjunath, 1929). The crude powder of *Butea monosperma* seeds (CP) showed a dose-dependent (1-3 g/kg) and a time-dependent anthelmintic activity in sheep. The anthelmintic activity of different species of *Butea* has been reported against *Ascaridia galli*, *Ascaris lumbricoides*, earthworms, *Toxocara canis*, oxyurids, *Dipylidium caninum* and *taenia* (Iqbal et al., 2006).

I. Wound healing activity

The topical administration of an alcoholic bark extract of *Butea monosperma* on cutaneous wound healing in rats. Full-thickness excision wound were made on the back of rat. The granulation tissue formed on days 4, 8, 12 and 16 (post wound) was used to estimate total collagen hexosamine protein, DNA and uronic acid. The extract increased cellular proliferation and collagen synthesis at the wound site as evidenced by increase in DNA, total protein and total collagen content of granulation tissues. The extract treated wounds heal much faster than normal animals as indicated by improved rates of epithelialization and wound contraction, tensile strength and histopathological examinations. *Butea monosperma* exhibited wound healing activities due to its antioxidant properties (Sumitra et al., 2005).

J. Thyroid inhibitory, Antiperoxidative and hypoglycemic effects

Stigmasterol isolated from the bark of *butea monosperma* was evaluated for thyroid hormone and glucose regulatory efficacy in mice. The administration at 2.6 mg/kg/d for 20 days reduced serum triiodothyronine (T3), thyroxine (T4) and glucose concentrations as well as the activity of hepatic glucose-6-phosphatase (G-6-Pase) with an increase in insulin. It showed thyroid inhibiting and hypoglycemic properties. Antioxidative potential due to decrease in the hepatic lipid peroxidation (LPO) and an increase in the activities of catalase (CAT), superoxide dismutase (SOD) and glutathione (GSH). The highest concentration tested (5.2 mg/kg) evoked pro-oxidative activity (Panda et al., 2009).

K. Liver disorders

An extract from the flowers of *Butea monosperma* is used in India for the treatment of liver disorders and two antihepatotoxic flavonoids, isobutrin and butrin have been isolated from the extract. (Wagner et al., 1986). The effect of pretreatment of methanolic *Butea monosperma* extract prior to TAA treatment at two doses and the results suggest that it may contribute to the chemo preventive effect. *Butea monosperma* showed a significant recovery in the level of glutathione and its metabolizing enzyme in the liver induced the detoxifying enzyme system, which is shown by the elevated levels of other QR, SOD and xanthine oxidase which are important second phase enzyme. (Sehrawat et al. 2006).

L. Giardiasis

Giardiasis is a common gastrointestinal infection caused by a protozoal parasite, *Giardia lamblia*. Pippali rasayana (PR). An Ayurvedic herbal medicine prepared from piper longum (Pippali) and *Butea monosperma* (Palash) in which ash of stem

, root, flower and leaves of *Butea monosperma* is used has significant activity against Giardiasis. It produced up to 98% recovery from the infection. The rasayana had no killing effect on the parasite in vitro. It induced significant activation of macrophages as evidenced by increased macrophages migration index (MMI) and phagocytic activity with higher doses of PR. Recovery increased up to 98% at 900 mg/kg. (Agarwal et al., 1994). Flowers of this plant are also effective in leprosy, leucorrhoea and gout (The wealth of India, 1988).

XI. CONCLUSION

Today it is a challenge for scientists to provide efficient, safe and cheap medications. In this scenario *Butea monosperma* can be an exclusive medicine which is widely available through our country. The present paper enumerates various pharmacognostic and pharmacological aspects of the plant. This review also summarizes the therapeutic potential of this plant. The plant is used highly by the rural and tribal people in curing various disorders. *Butea monosperma* has an effective natural origin that has a tremendous future for research. It is very essential to have a proper documentation of medicinal plants and to know their potential for the improvement of health and hygiene through an ecofriendly system. The present review describes various traditional and medicinal utility of the plant and an attempt was made to gather information about the chemical composition and pharmacological activity of the plant and its constituents.

REFERENCES

- [1] A.K., Singh, M., Gupta, N., Saxena, R., Puri, A., Verma A.K., Saxena, R.P., Dubey C.B. and Saxena K.C. Management of giardiasis by an immunomodulatory herbal drug Pippali rasayana, J of Ethnopharmacology, 44 (1994) 143-146
- [2] Ambasta, B.P., The useful plants of India, 1994, 1-91, CSIR, New Delhi.
- [3] Bandara, B. M. R., Kumar, N. S., Wimalasiri, K.M.S. Journal of the National Science Council of Sri Lanka 18, Agarwal 97-103,
- [4] Barua, A. K., Chakrabarti, P. I., Das, K.G., Nair, M.S. B. Chemistry & Industry (London, U. K.) 1970, 1376.
- [5] Bavarva, J.H. and Narasimhacharya, A.V.R.L. Preliminary study on antihyperglycemic and antihyperlipaemic effects of *Butea monosperma* in NIDDM rats. Fitoterapia 79, 2008, 328-331
- [6] Bhalla, V., Walter, H. Research Bulletin of the Punjab University, Science 48, 1999, 87-94.
- [7] Bhargava, S.K., Estrogenic and postcoital anti-conceptive in Rats of butin isolated from *Butea monosperma*, J of Ethnopharmacology, 18, 1986, 95-101.
- [8] Bishnoi, P., Gupta, P.C. Planta Medica 35, 286-288, 1979, 286-288.
- [9] Boutelje JB. Encyclopedia of world timbers, names and technical literature (Ency W Timber) 54, 1980.
- [10] Chandra, S., LaI, J., Sabir, M. Indian Journal of Pharmacy, 39, 1977, 79-80
- [11] Chatterjea, J. N., Sengupta, S.C., Misra, G. S., Agarwal, S. C. Indian Journal of Chemistry, Section B 14B, 1976, 719-721.
- [12] Cherdshewasart, W. and Nimsakul, N. Asian J of Andrology, 5, 2003, 243-246.
- [13] Chopra, R.N., Chopra, J.C., Handa, K.L. and Kapur, L.D., Indigenous drugs of India, 1958.
- [14] Cowen DV. Flowering Trees and shrubs in India, Sixth Edition. Bombay: Thacker and Co. Ltd. Agroforest Today 6:7, 1984.

- [15] Dixit, V.P., Agrawal, M., Bhargava, S. K., Gupta, R.S., Jain, G. C. *Iugoslavica Physiologies et Pharmacologics Acta* 17, 151-162, 1981,151-162.
- [16] Ghosh, B., Dasgupta, B. and Sircar, P. K. *Indian Journal Biochemistry Biophysics* 18, 1981,166-169.
- [17] Guha, P.K. Pot, R. and Bhattacharyya, A. An imide from the pod of *Butea monosperma*. *Phytochemistry*, 29(6), 1990,2017.
- [18] Gunakkunru, A. Padmanaban, K., Thirumal, P., Pritila, J., Parimala, G. Vengatesan, N., Gnanasekar, N., Perianayagam J., Sharma, S.K. and Pillai K.K., Antidiarrhoeal activity of *Butea monosperma* in experimental animals, *J of Ethnopharmacology*, 98, 2005, 241-244.
- [19] Gupta, S. R., Ravindranath, B. and Seshadri, T.R. *Phytochemistry*, 1970, 2231-2235.
- [20] Gupta, S.R., Ravindranath, B. and Seshadri, T, The glucosides of *Butea monosperma*. *Phytochemistry*, 9(10), 1970, 2231-35
- [21] Indurwade, N.H. Kawtikwar, P.S., Kosalge, S.B. and Janbandhu, N.V., Herbal plants with aphrodisiac activity. *Indian Drugs*, 42 (2), 67-72 (2005).
- [22] Iqbal, Z, Lateef , M, Jabbar, A , Ghayur M.N. and Gilani A.H., In vivo anthelmintic activity of *Butea monosperma* against *Trichostrongylid nematodes* in sheep. *Fitoterapia* , 77 , 2006, 137-140
- [23] Jain, S.K., *Dictionary Indian Folk Medicine and Ethnology*, (Deep publication, New Delhi, India), 1991.
- [24] Kala , C., Prioritization of medicinal plants on the basis of available knowledge, existing practices and use value status in Uttaranchal, India, *Biodivers. & Conserv.* 13, 2004, 459.
- [25] Kasture, V.S., Kasture, S. B., Chopde, C.T. *Pharmacology, Biochemistry and Behavior* 72, 2002, 965-972.
- [26] Kasture, V.S., Kasture, S.B. and Chopde, C.T., Anticonvulsive activity of *Butea monosperma* flowers in laboratory animals. *Pharmacology, Biochemistry and Behavior* 72, 2002, 965-972.
- [27] Kasture, V.S., Chopde C.T. and Deshmukh V.K. Anticonvulsive activity of *Albizia lebeck*, *Hibiscus rosa sinensis* and *Butea monosperma* in experimental animals. *J of Ethnopharmacology* , 71 , 2000, 65-75.
- [28] Katti, M.C.T., Manjunath, B.L. *J. Indian Chem. Soc.* 6, 839-845, 1929, 839-845.
- [29] Kirtikar, K.R. and Basu, B.D. *Indian medicinal plants*, Edn 2, Vol-I, Lalit Mohan Basu Allahabad, India, 1935, 785-788.
- [30] Kornkanok, I., Prapapan, T., Kanchanaporn, C., Thitaree, Y., Warawit, T. *Journal of Ethnopharmacology* 89, 2003, 261-164.
- [31] Lavhale, M.S. and Mishra, S.H., Evaluation of free radical scavenging activity of *Butea monosperma* Lam., *Indian. J. Exp. Biol.* 45, 2007, 376-384.
- [32] Madhav, R. Seshadri, T.R. and Subramanian, G.B.V., Structural investigations of lac resin: I. Chemical studies on hard resin. *Indian. J. Chem. Sec. B*, 5: 132 (1967).
- [33] Maurya, R., Yadav, D.K., Singh, G., Bhargava, B., Murthy, P.S.N., Sahai, M. and Singh M.M., Osteogenic activity of constituents from *Butea monosperma*, *Bioorganic & Medicinal Chemistry Letters*, 19, 3, 2009, 610-613.
- [34] Mehta, B. K., Bokadia, M. M. *Chemistry & Industry* (London, U. K.), 1981, 98.
- [35] Mengi, S.A. and Deshpande, S. G., *J of Pharmacy and Pharmacology* 47, 1995, 997-1001.
- [36] Mishra, M., Yogendra, S. and Kumar S., Euphane triterpenoid and lipid constituents from *Butea monosperma*, *Phytochemistry*, 54, 2000, 835-838.
- [37] Murti, P. B. R., Seshadri, T.R. *Proceedings Indian Academy of Sciences, Section A* 20A1, 1944, 279-291.
- [38] Murti, P. Bhaskara, R. and Krishnaswamy, H. *Proceedings - Indian Academy of Sciences, Section A* 12A , 1940, 472-476,
- [39] Nadkarni, K.M., *Indian Materia Medica*, Vol-I, 2002, 223-225.
- [40] Panda, S., Jafri, M Kar, A and Meheta, B.K., Thyroid inhibitory, antiperoxidative and hypoglycemic effects of stigmasterol isolated from *Butea monosperma*. *Fitoterapia* 80, 2, 2009, 123-126
- [41] Pangsrivongse, K. *Rev. Filipina Med. Farm.* 29, 12-14, 1938, 12-14.
- [42] Porwal, M, Sharma ,S. and Mehta, B.K., Isolation and identification of a new derivative of aliphatic acid from the seed coat of *Butea monosperma* (Lam.) Kuntze. *Indian. J. Chem. Sec. B*, 27(3), 1988, 281-182.
- [43] Prasad, R. B. N., Rao, Y.N., Rao, S.V. *J. Am. Oil Chem. Soc.* 64, 1987, 1424-1427.
- [44] Ramana, D.B.V., Singh, S., Solanki, K.R. and Negi, A.S., *Animal feed science and technology*, 88, 2000, 103-111.
- [45] Rasheed, A., Alam. M. Tufail, M., Khan, F.Z. *Hamdard Medicus* 36, 1993, 36-39.
- [46] Rastogi, R.P. and Mehrotra, B.N. *Compendium of Indian Medicinal Plants*, (CDRI, Lucknow and Publication and information Directorate, New Delhi), Vol. II, 115 (1979).
- [47] Razdan, M. K., Kapila, K., Bhide, N. K. *Indian Journal Physiology Pharmacology* 14, 57-60, 1970.
- [48] Robinson, G.M. Formation of cyanidin chloride form a constituent of the gum of *Butea frondosa*. *J. Chem. Soc.* , 1937, 1157.
- [49] Saxena, V, Sharma, V.K. and Devendra, N. *Journal of the Institution of Chemists (India)* 70, , 1998, 218-220.
- [50] Schoeller, W, Dohrn, M and Hohlweg, W, Estrogenic products. Patent: US 2,112,712 .1938:2.
- [51] Schoeller, W., Dohrn, M., Hohlweg, W. *Naturwissenschaften* 28, 532-533, 1940, 532-533.
- [52] Sehrawat, A. , Khan, T.H., Prasad, L. and S. Sultana, S., *Butea monosperma* and chemomodulation: Protective role against thioacetamide-mediated hepatic alterations in Wistar rats. *Phytomedicine* 13 .2006, 157-163.
- [53] Sequeira, V and Bezkorowajnyj, P.G. Improved management of *Butea monosperma* Lam./Taub for lac production in India, *Forest Ecology and Management*, 102, 1998, 225-234.
- [54] Shah, K.C., Baxi, A.J. and Dave, K.K. *Indian Drugs* 29, , 1992, 422-423.
- [55] Shah, K.G., Baxi, A.J., Shukla, V.J. , Dave, K.K., De, S. and Ravishanker, B. *Indian Journal of Pharmaceutical Sciences* , 52, 1990, 272-275.
- [56] Shahavi, V.M. and Desai, S.K., Anti-inflammatory activity of *Butea monosperma* flowers, *Fitoterapia*, 79, 2008, 82-85.
- [57] Sharma, S., Batra, A., Mehta, B.K. *Indian Journal of Chemistry, Section B* 30B, 1991, 715-716.
- [58] Shukla, Y.N., Mishra, M., Kumar, S. *Indian Journal of Chemistry, Section B* 41 B, 881-883, 2002, 881-883.
- [59] Shukla, Y.N., Mishra, M., Kumar, S. *Indian Journal of Chemistry, Section B* 41 B, , 2002, 1283-1285.
- [60] Singh, A.N., Upadhye, A.B., Mhaskar, V.V. and Dev, S., Components of soft resin. *Tetrahedron*. 30(7), 867-74 (1974).
- [61] Somani, R. Kasture, S. and Singhai, A., Antidiabetic potential of *Butea monosperma* in Rats, *Fitoterapia*, 77, 2006, 86-90.
- [62] Sumitra, M, Manikandan , P and Suguna, L , Efficacy of *Butea monosperma* on dermal wound healing in rats, *The International Journal of Biochemistry & Cell Biology* 37 , 2005 , 566-573.
- [63] Tandon, S. P., Tiwari, K.P., Saxena, and V.K. *Proceedings of the National Academy of Sciences, India, Section A: Physical Sciences* 39, 1969, 237-239.
- [64] *The Wealth of India-Raw Materials*. PID, CSIR, New Delhi, 1988, 341-346.
- [65] Wagner, H., Geyer, B., Fiebig, M., Kiso, Y., Hikino, H. *Planta Medica* 52, 1986, 77-79.
- [66] Wongkham, S., Wongkham, C, Trisonnithi, C, Boonsiri, P., Simasathiansophon, S. and Atisook, Kanit, Isolation and properties of a lectins from the seeds of *Butea monosperma*, *plant science* , 103, 1994, 121-126.
- [67] Yadav, R.N., Singh, R.K. *Journal of the Institution of Chemists (India)* 70, , 1998, 9-11

AUTHORS

First Author – Divya fageria ,Ph.D scholar ,University of Rajasthan, Jaipur

Second Author – Dr.D.V.Rao, Associate professor, university of rajasthan, Jaipur

Correspondence Author – Institute address: Biotechnology lab, lab no.5, Department of botany, University of rajasthan, Jaipur. Residence address: Behind Police line, Balram nagar, Sikar, Email: divyafageria123@gmail.com

