

DHĀK BUTEA MONOSPERMA-A REVIEW ON ETHNOBOTANICAL AND UNANI PROSPECT AS WELL AS PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES

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ABSTRACT

A large fraction of the world population, especially in the developing and underdeveloped countries depends mainly on the traditional system of medicine. India is well recognized for their traditional systems of medicine such as Unani, Ayurveda and Siddha that prevailed here from centuries and these are important components of the health care system. Unani Medicine is worldwide well ancient traditional system of medicine. There are over 25,000 herbal products documented in the traditional medical literature. In India more than 43% of the total flowering plants are reported to be of medicinal importance. The drugs in Unani system of medicine are derived from three sources i.e. plant, animal and mineral but mainly from herbs. *Dhāk* (*Butea monosperma*) one of the important medicinal plants in Unani medical system is used for therapeutic purpose. Many Unani scholars mentioned this drug in their treatises. Also, there exists a vast knowledge in the form of non codified or oral tradition for therapeutic uses of *Butea monosperma*. Different parts of the plant including bark, root, gum, leaves, flowers and seeds show pharmacological activities due to presence of Phytoconstituents like, Butrin, alkaloids, monospermaside, glucosides, triterpenes and various elements. In this paper, the botanical description of the drug is provided along with the pharmacological actions, therapeutic uses, dose and uses mentioned in Unani classical literature with ethno-botanical uses as well as phytochemical and pharmacological studies on this important plant.

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Keywords: Dhāk, Unani medicine, pharmacological studies, *Butea monosperma*.

INTRODUCTION

Since last few decays it is observed that there has been increased global interest in traditional systems of medicine. Alternative medicines are being used by about 60 percent of the world's population. These medicines are not only used by the rural masses for their primary health care in developing countries but are also used in developed countries where modern medicine dominates [1]. In the Western countries, near about 40 per cent of people are using the herbal medicine for the treatment of various diseases. Increased side effects, lack of curative treatment for several chronic diseases, high cost of drugs, microbial resistance and new emerging diseases are some driving forces for renewed public interest in

complementary and alternative medicines. According to World Health Organization (WHO) more than 80% of the world's population relies on traditional medicine for their primary healthcare needs. The World Health Organization (WHO) has also recognized the Unani System of Medicine as an alternative system to cater the health care needs of human population [2]. India has the privileged of having popular ancient traditional systems of medicine including Unani system of medicine that are practiced here and play an important role in delivering health care for humanity. Plants are treasure of medicine. Documentation of traditional knowledge accessible from classical texts on medicinal uses of plants has provided many important drugs of modern

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day. The drugs in Unani system of medicine are derived from plants, animal and mineral sources but mainly from herbs.

Dhāk (Butea monosperma Lam.) is one of the important medicinal plants. Many Unani scholars had mentioned this drug in their respective treatises. It belongs to the family Fabaceae or Leguminosae and genus Butea. The genus Butea includes various species like Butea monosperma, Butea minor and Butea superb, Butea frondosa, etc. and is widely distributed throughout India [3]. The specific name monosperma means one seeded and refers to the fruit with a single seed [3, 4]. Like other plants, *Dhāk* also contains number of Phytoconstituents, which are the key factors in the medicinal value of this plant. The bark, gum, leaves and flowers have pharmacological activities like *Muhallil* (anti-inflammatory), *Muqawwī-i-Bāh* (Aphrodisiac), *Hāzim* (digestive), *Mushtahī* (Appetizer), *Qātil-i-Dīdān* (Anthelmintic), etc.[4]. Commonly, Butea monosperma is used as tonic, astringent, aphrodisiac and diuretics. Roots are useful in filariasis, night blindness, helminthiasis, piles, ulcer and tumors.

Methodology: Library of Central Council for Research in Unani Medicine (CCRUM), Headquarters, New Delhi. Library of the Institute and internet were searched for Unani classical texts, ethnobotanical uses and pharmacological studies on Butea monosperma.

TAXONOMICAL CLASSIFICATION

Kingdom: Plantae
 Sub-kingdom: Tracheobionta
 Super division: Spermatophyta (seed plant)
 Division: Magnoliophyta (flowering plant)
 Class: Magnoliopsida (Dicotyledon)
 Subclass: Rosidae
 Order: Fabales
 Family: Fabaceae or Leguminosae (pea family)
 Genus: Butea
 Species: Monosperma (Lam.) Taubert
 Synonyms: Butea frontdosa Koeng ex Roxb.

Dīgar Nām (Vernacular names) [3,4-12]:

Unani: Dhāk, Tesu, Persian: Pālah, Palās, Darakht-i-Palās; Arabic: Lāib al- Palās [7]; Sanskrit: Palāsa, Kinsuka; Hindi: Dhāk, Palāsha, Ghuniya gond, Farās, Kankeri, Tesu; Urdu: Palās English: Bastard Teak, Bengal Kino, Dony branch Butea, gum as Butea gum, Flame of the forest; Bengali: Palās Gāj; Gujarati: Khākara, Khānkār, (Kesudo, Khakapado; Marathi: Kakracha, Padas); Kannad: Muttug, Muttuga, Muttala; Telugu: Moduga, Modugu, Chettu, Kalu ka Chattu; Tamil: Palasam, Murkampoo, Purasu, Parsan;

Kannada: Mutthala, Muttuga; Malayalam: Brahmavriksham, Kimshukam, Palas; Punjabi : Chichra, Palash, Dhāk Palas; Gwalior: Beej pak; and French: Butee- feuillue .

Habitation

It is native to tropical region of southern Asia from Pakistan, India, Bangladesh, Nepal, Srilanka, Myanmar, Thailand, Laos, Cambodia, Vietnam, Malaysia and Indonesia [13]. In India, extending in its mountainous part in the North west Himalayas upto 1000 m , all over Bengal and South India. Plant grows extrovertly on open grass land and scattered in mixed forest [6].

Plant Description

It is a famous, beautiful, big sized deciduous tree [9,14] having a crooked and irregular trunk, about 50 feet in height. Trunk is about 6 to 10 feet in diameter. Branches are irregular inflorescence brown velvety. The bark is thick about 1.25 to 2.5 cm thick, light ash coloured to pale brown, curved, and is rough due to presence of rhytidoma, and scattered dark brown spots of exudates. Rhytidoma 0.2 cm thick and usually peels off leaving light brown surface, exfoliation of cork and presence of shallow longitudinal and transverse fissures; internal surface is rough and pale brown and taste slightly astringent [11]. Leaves are trifoliate, large and stipulate, 10-15 cm long and has very bitter taste [4,14]. Leaflets are coriaceous (the terminal 10-20 cm long and as broad as long), broadly obovate, glabrescent above, finely silky and strongly veined beneath with cunnate or rounded at the base. The central leaf is rounded whereas lateral leaves are long. New leaves appear in the month of *Baisākh* [11,15]. Flowers are large, scarlet and orange coloured, rigid racemes, 15 cm long. 3 flowers together form swollen nodes of stout, axillary and terminal racemes; calyx is grey clothed with silky hairs within, brown and velvety outside; the two upper teeth are connate and large whereas 3 lower ones are unequal. The corolla is 4-6 cm long and 1.7-2 fm broad, bright orange-red, covered outside with silky hairs, papilionaceous, reflexed, veined in a parallel fashion, the wing petals incurved, ad pressed to the keel, semi orbicular, acute veined, the two petals connate. Stamens diadelphous (9+1), vexillary stamen free and shortest, the other are connate. Anthers yellow linear, ovary stipitate, silky pubescent, style longer than the stamen, stigma is small truncate. Flower has slightly bitter taste [6]. These tend to be densely crowded on leaflet branches, appearing in February and stay on nearly up to April to May [16]. The flowers appear on the upper portion of the tree giving the appearance of a flame from some distance [5, 10, 16]. On the basis of flower colour, it has four varieties- (1) red

orange, (2) yellow, (3) bluish and (4) white which is rarest [4, 10, 15]. One type of *Butea* species is described as climbing shrub in Unani literature on single drugs [10, 15] and it resembles which is described as *Butea Parviflora* [3]. Petal resembles with the nail of lion [8, 15]. Flowers are known as *Gul-i-Tesu* or *Gul-i-Dhāk* and used for ornamental purpose also [15]. The pod is a flat legume. Pods are long, stalked, 12.5-20 cm by 2.5-5 cm; thickened at the sutures. Young pods have a lot of hair, a velvety cover and mature pods hang down, one seeded. Pods attain maturity in September to October [11]. Each pod contains single seed. Seed is known as *Tukhm-i-Palās*, *Tukhm-i-Pālah* or *Palās pāprah*. The seeds are flat, rounded or kidney shaped and light in weight [11, 15], it is about 25 to 40 mm long, 15 to 25 mm wide, and 1.5 to 2 cm thick, reddish brown in colour and compressed laterally, mucilaginous and oily but devoid of any taste and smell. Average weight of a seed is 1.09 gm [11]. Shell life of seed is one year [15]. The seed-coat is pale yellow or reddish-brown in colour, thin, smooth distinctly veined, and encloses two large, leafy yellowish cotyledons. Hilum is prominent; cotyledons are large, fleshy, cream coloured and almost flat laterally. The dicotyledonous embryo fills up the major portion of seed. Cotyledon consists of thin walled parenchymatous cells filled with granular proteinaceous mass and aleurone grains and other cellular contents [7, 11]. Oil is extracted from the seed [4, 15]. Exudation which is obtained from bark hardens into a red brittle resin commonly known as *Samagh-i-Dhāk*, *Samagh-i-Palās*, *Chuniya Gond*, *Kamarkas* [4,17]. It is highly beneficial for women [3,14]. The drug *Lākh* (lacquer) which is usually produced on trees like mango tree, peepal tree, babool tree but, these days, *Butea* tree is also a host to the Lac insect, which produces natural lacquer. The lacquer produced on this plant is reddish coloured and is of very good quality. People of Kheera district in Nepal is producing lacquer on this tree for its import [15].

Hissa Mustāmila (Part Used):

Barg (leaf), *Gul* (flower), *Samagh* (gum), *Tukhm* (seed), *Chhāl* (Stem bark), [4,6-11,18] and *Bekh* (root) also [4,8].

Mizāj (Temperament):

In the opinion of Unani scholars the temperament of plant is *Hār, Yābis* (Hot and Dry) [10] or *Hār, Ratab* (Hot and Wet) [15,18]. Unani scholars have also mentioned the temperament of its various parts that is mentioned below:

Flower- *Hār, Yābis* (Hot and Dry) [6] but according to some Unani physicians the temperament of flower is

Bārid, Yābis (Cold and Dry) [19] and slightly deviated towards hotness [8,15].

Seed: Its temperament is *Hār³, Yābis³* (Hot 3⁰ and Dry 3⁰) [11,15] but its temperament is mentioned as *Hār, Tar* (Hot and Wet) in *Makhzan al-Advia* [18]

Leaf- It is *Hār³ Ratab⁴* (Hot and Wet) [4]

Gum- *Bārid, Yābis* (Cold and Dry) 15, 17], or *Hār, Yābis* (Hot and Dry) [8].

Stem bark- *Bārid², Yābis²* (Cold 2⁰and Dry 2⁰) [12];

Phytochemical constituents of *Butea monosperma*:

Different Phytoconstituents are present in various parts of the plant and isolated which are responsible for number of pharmacological activities.

The main constituent of the flower is triterpene and glycosides like butrin, isobutrin, coreopsin, isocoreopsin, sulphurin, monospermaside, isomonospermaside, besides butein (0.37%) and butin (0.04%). Flower also contains flavonoids, steroids, Alkaloids, Steroid, tannins and sugar. Mineral contents like magnesium, sodium, calcium, iron, nitrogen and potassium are present in the flower [6]. Seed contains fats and oil, lignin, proteins, mucilage and small amount of resin. A nitrogenous acid compound and palasonin is isolated from seeds, two glucosid- monospermaside and isomonospermaside, and butrin, isobutrin coreopsin, isocoreopsin, sulphurein- α -amyrin. β -sitosterol, and sucrose isolated from seed. Seed oil contains, glyceides of palmitic stearic, , lignociric, oleic and linoleic acid. A lactone n-heneicosanoic acid- δ -lactone is isolated and identified in it [7]. Root of contains glucose, glycine, glucosides and aromatic compounds. Tetramers of leucocyanidin are isolated from gum and stem bark. The bright colour of the flower is attributed to the presence of chakones and aurones [3, 5, 20]. Powdered leaf revealed the following compounds - Alkaloids, cynogenic glycosides, phenolic compounds, flavonoids, terpenoids, tannins and saponins [6, 11]. Gum and bark contain kino tannic and gallic acid [3, 12].

Physicochemical Standards of *Dhāk* (*Butea monosperma*)

Physicochemical standards of a drug ascertain the quality of the drug because the therapeutic actions depend upon the secondary metabolites and chemical constituents of the drug. The variation in the standards may result in disparity in the therapeutic actions. To avoid batch to batch variation and to get desired

therapeutic effect at specified dose the standards should be checked in the crude drug before using it. The checking of standards is necessary whether drug is used as single entity or as an ingredient in the compound formulation. The following standards have been laid down for its quality check of *Gul-i-Tesu* and *Palās pāpda* by Central Council for research in Unani Medicine:

Flower [6]

- Foreign organic matter: Not more than 1%
- Total Ash: Not more than 7 %
 Acid insoluble ash: Not more than 2%
 Water soluble Ash : Not more than 6%
- Hexane: 0.74 %
- Chloroform: 0.3%
- Ethanol: 28.78%
- Distilled water: 13.48

Seed [11]

- Foreign organic matter: Not more than 1%
- Total Ash: Not more than 7 %
 Acid insoluble ash: Not more than 3%
 Water soluble Ash : Not more than 4%
- Hexane: 1.01 %
- Chloroform: 0.3%
- Petroleum ether: 1.19 %
- Sovent ehter: 1.49 %

Af'al (Pharmacological action)

In Unani system of medicine various parts of the plant are used as these show pharmacological actions:

As per Unani medicine, flower is *Qābiz* (Astringent), *Muhallil-i-Waram* (Anti-inflammatory) as well as *Rād'e* (Repellant) *Mudirr-i-Bawl* (Diuretic), *Muqawwī-i-Bāh* (Aphrodisiac), *Mudirr-i-Hayz* (Emmenagogue) and *Muqawwī* (General tonic) [6, 14], *Daf'-i-Fasād al-Dam*, *Balgham wa Safra* (removes morbid sanguine, phlegm and bile) [4,9] *Mukhrij-i-Balgham* (Expellant of phlegm) , *Mufarreh* (Exhillirant), *Muqawwī-i-Qalb* (Cardiac tonic), *Mu'addil-i-Akhlat* (brings humours in moderate balance), *Mudirr-i-Hayz* (emmenagogue) [4, 8,10,15]; Seed is *Qatil-i-Deedan* (Anthelmintic), *Mudirr-i-Bawl* (Diuretic), *Muhallil-i-Waram* (Anti-inflammatory), *Kasir-i-Riyah* (Carminative), *Muqarreh* (Wound producing agent) (4, 8, 11,14,15]. Seed also has

the property of reducing *Balgham* (Phlegm), and *Sawda* (black bile), and *Man'e Hamal* (contraceptive) like pharmacological activities [10,15]; Seed oil is *Muharrak-i-Bāh* (sexual stimulant), *Qāt'e Safra* and *Qat'e Balgham* (reduces bile and phlegm production) [4,14,15] ; Leaf is *Mushtahī* (Appetizer), *Mulayyin* (laxative) [9, 15, 19], *Muhallil* (Resolvant) and *Muharrak-i-Bāh* (sexual stimulant) [4]; Stem bark is *Qābiz* (astringent), *Mughalliz-i-Manī* (Semen Inspissant), *Qātil-i-Kirme Am'a* (Vermicidal) [12]. Gum is beneficial for *Kulliya* (kidney) and *Mughalliz* (Semen Inspissant), *Muqawwī-i-Zohar* (tonic for back/spine) [4,8,10], *Muqawwī-i-Reham* (Tonic for uterus) [10], *Mumsik* (Retentive), *Qābiz-i-Meda* (constipative), *Muqawwi-i-Bāh* (Aphrodisiac) and *Mujaffif* (Desiccant) [8,14]. Gum is beneficial for brain and enhances memory as well [4].

Istemāl (Therapeutic Uses)

Flower cures epistaxis, jaundice, pruritus, helminthiasis, swellings in the organs, boils and abscess and ringworm, '*Usr-i-Bawl* (Dysuria), *Waj'a al-Masāna* (Cystitis), *Ehtabās-i-Bawl* (anuria), *Ehtabās-i-Tams* (Ammenorrhoea) when used in various dosage form [4, 8, 10, 14, 15]. Flowers are used to cure diarrhea, predominance of bile, inflammation and gonorrhea [6]. *Matbūkh Gul-i-Tesu* (flower decoction) is beneficial for epistaxis when used orally along with 48ml of *Sharbat 'Unnāb*. Oral administration of *Naqū* (infusion) of flower is effective in *Yarqān Asfar* (jaundice) and *Suzāk* (gonorrhea) [4,15]. *Safūf* (powder) is also beneficial for *Suzāk* (gonorrhea) and *Ishāl* (diarrhea) [8,14]. Flower juice is useful for helminthiasis, pruritus, and diarrhea and corrects humoral imbalance [4]. Oral administration of '*Araq Gul-i-Tesu* (flower distillate) is beneficial for heart [4]. *Takmīd* (hot fomentation) with poultice of flowers produces diuresis and increases menstrual flow [6]. Hot fomentation and sitzbath with decoction of flowers is used to reduce *Awrām* (inflammation) of the organs like oophoritis, orchitis, uterine pain and cystitis and pain associated with it [4, 14, 15]. *Natūl* (Irrigation of lukewarm decoction) and *Zimād* (Paste) prepared with flower when applied externally is useful for *Waram-i-Unsayayn* (oophoritis), *Waram-i-Khusiya* (orchitis), *Ehtabās-i-Tams* (ammennorrhoea), *Ehtabās-i-Bawl* (anuria) , '*Usr-i-Bawl* (Dysuria), *Qīla Māiyya* (Hydrocele) and diseases of kidney and urinary bladder [4, 9,]; *Safūf* (powder) of dried buds in a dose of 2-3 gm is given for constriction of vagina ([14, 15]. Seed is used as vermicogue and oral administration of seed powder is used to treat *Dīdān-i-Am'a* (Helminthiasis), *Nafakh* (Flatulence), *Amrāz-i-Kulliya wa Masāna* (diseases of

kidney and urinary bladder), *Tasammum* (poisoning), *Lasāt -ul-Huwām* (Insect bite) or snake bite, *Bawāsīr* (haemorrhoids) and is beneficial for *Sar'* (epilepsy) [4, 7,15]. It is used orally in form of decoction, linctus, powder or locally to treat these diseases [4, 15]. Eye drops prepared with *Namak Lāhorī* (Rock salt) and seed and stem bark of *Butea*, (each 1part) ground with rose water is useful in corneal opacity. Instillation of nasal drops prepared with seed and water is effective for epilepsy, it recovers consciousness during epileptic convulsion [4]. Use of vaginal pessary prepared with seed and honey prevents conception. Local application in form of paste is effective for *Waram-i-Khusiya* (Orchitis), *Khārish* (Pruritus), *Dād* (Ringworm) and abscess. Seeds pounded with *Āb-i-Līmū* (lemon juice) or *Sirka* (vinegar) is applied on skin infection or *Dād* (ring worm) [14, 15]. Seed kernel is beneficial for *Hūmma Rib'a* (Quartan fever) when used with kernel of *Karanjwa* (*Caesalpinia bonduc* Flem.). Seed oil is effective when applied locally on inflammation and swellings of cold type, Piles, and Anal prolapse; Leaves are useful for *Dumbal* (boil) and *Dubaila* (abscess), *Jāla* (corneal opacity), *Kirm-i-Shikam* (helminthiasis), *Qūlanj Rīhī* (colic pain due to flatulence), *Bawāsīr* (haemorrhoids) [9], *Zarab wa Khilfa* (sprue) and *Kasr* (fracture) [4,19]; New leaves dried in shade, ground and taken orally in a dose of 18 gm daily in the morning for 3 days is effective for *Sayālān al-Reham* (leucorrhoea) [11,15]; Ash of leaves and branches is beneficial for *Istisqā* (ascites) [4,9]. Eating in the bowl prepared with its leaves or on the leaves enhances appetite [15]. Stem bark is useful in *Ishāl* (Diarrhea), *Jāla* (Corneal opacity); stem bark and gum is useful in *Sayalān al-Reham* (Uterine discharge), *Jiryān* (premature ejaculation), *Riqqat-i-Manī* (Thinning of semen). Gum is also effective for *Bawsāsīr* (haemorrhoids), *Hurqat al-Bawl* (burning micturition), *Qurūh-i-Masāna* (urethral and cystic wound/ulcers), *Suzāk* (gonorrhea), *Sayalān al-Reham* (vaginal discharge), *Zo'f-i-Ām* (General weakness) and highly beneficial for women during puerperium [14]. Root is beneficial in epilepsy and haemorrhoids [4, 12, 15]. Near about all parts of *Butea* plant is useful in *Jiryān* (premature ejaculation) [19].

Miqdār (Dose)

Flower: 5-10 gm; [6]; 7-12 gm [8]

Seed: 125-300 mg [11], 300-900 mg [7,14]; upto 875 mg [4] upto 937 mg [15]; 250 mg-1 gm [8].

Stem bark: 5-12 gm [8], 5-10 gm in decoction [12]

Leaf: 3-5 gm [8]

Gum: 1-3 gm [8]

Muzir (Toxicity)

Flower is harmless [6] but according to some physicians, it is not suitable for cold temperament personnel [8]. Seed is harmful for lungs [11]. Seed, leaf and stem bark show harmful effect on intestines and gum is not suitable for lower extremities [8].

Musleh (Corrective)

It is used to reduce adverse effects or to improve efficacy of the drug. As the various parts of the plant have some adverse effect on a particular organ therefore corrective for each part is also mentioned by Unani scholars:

Namak (salt) for flower [8]; '*Araq-i-Gulāb* (Rose water) [8, 11] or *Makkhan* (butter) or *Roghān Gāw* (pure ghee) [4,18] for seed; *Gulāb* (*Rosa damascena* Mill.) and *Babūna* (*Matricaria chamomilla* Linn.) for leaf and stem bark; *Katīra* (*Astragalus gummifer*), *Sandal* (*Santalum album* Linn.) for gum [8].

Badal (Substitute)

Substitute of any drug is required in conditions where it is not available. The substitutes mentioned for various parts of the *Butea* plant by Unani scholars are as follows: Flower: *Kāsnī* (*Cichorium intybus* Linn.) Leaf: *Barg-i-Shaftālū* (leaf of *Prunus persica* (Linn.) Batsch) [8] ; Seed: *Khardal* (Seed of *Brassica nigra* Linn.); Gum: *Samagh 'Arabī* (gum of *Acacia Arabica* Willd.) [8].

Murakkabāt (Compound formulations)

Drugs from plant, mineral and animal origin have been used either as single entity or in combination of more than one drug in specific proportioned mentioned in Unani Pharmacopoeias and National formularies. If more than one drug has been mixed in specific proportion and method then it is called compound formulation. It is used in various dosage forms and various parts of the *Butea monosperma* are included as an important ingredient in different compound formulations of Unani system of medicine. The actions of the formulation and their therapeutic effects are also mentioned with each:

- *M'ajūn Supāri Pāk* (contains *butea* gum)- It is aphrodisiac, helps in conception, strengthens back and useful in *Sayalān al-Reham* (vaginal discharge) [21, 22].
- *M'ajūn Hindī* (contains gum and stem bark)- It is *Muqawwī-i-Bāh* (Aphrodisiac) and *Mumsik* (Retentive) [22]. These parts are also included as an ingredients in various other formulations of *Safūfāt* (Powders) [21] and *Majūnāt* (semi-solid sweet preparation) which are *Muqawwī-i-Bāh*

- (Aphrodisiac), *Mumsik* (Retentive) and useful in premature ejaculation and vaginal discharge [22].
- *Matbūkh Muhallil* (contains flower) [6] and water boiled with flower is an anti-inflammatory and used for *Ābzān* (Sitzbath), *Takmīd* (hot fomentation) and *Natūl* (pouring medicated water at some distance) in case of *Waram* (inflammation) of organs.
 - *Habb-i-Dīdān* (contains seed): It has anthelmintic and vermicogogue actions and useful for helminthiasis [11].
 - *Qurs Dīdān* (containing seed): It has anthelmintic action and useful for helminthiasis [7].
 - *Itrifal Dīdān* (contains seed): It has vermicide and vermicogogue actions and useful for helminthiasis [7]
 - *Safūf Mu'allif* (contains seed): It has aphrodisiac and retentive pharmacological action and useful for sexual debility [12]
 - *Safūf Mumsik* (contains seed): It has retentive actions and useful for premature ejaculation and spermatorrhoea [21].
 - *Safūf Hindī* (contains gum) and
 - *Safūf Māsik al-Manī* (contains gum): These powder formulations are retentive and Semen inspissant and effective in premature ejaculation [21]
 - *Safūf Sayalān* (Contains gum): Polyherbal powder preparation is *Qābīz* (styptic) and *Hābis* (astringent) by temperament and *Mujaffīf* (dessicant), *Muqawwī* (tonic) by action, and is used to treat *Sayalān al Reham* (leucorrhea). [23]

Ethnobotanical Uses of *Butea monosperma*

The plants of this genus are well known for their colouring matters. It is reported to possess antifertility, aphrodisiac and analgesic activities.

The stem bark is useful in indigenous medicine for the treatment of dyspepsia, diarrhea, dysentery, ulcer, sore throat and snake bite [3]. Flowers are astringent, tonic, diuretic, anticonvulsant, anti-inflammatory, antiulcer, hepatoprotective, and are useful in diarrhea, leprosy, skin diseases, gout, thirst, burning sensation, and thirst [24]. Leaf is spasmolytic; flower possesses antifertility action, gum is astringent, useful in diarrhea and dysentery; Decoction of flowers is given twice daily for 15 days to treat diarrhea [16]. Gum is given orally in a

dose of 1 gm for 2-3 times daily for 1-2 days in case of inflammation of liver. Leaves are astringent and tonic [16]. Root is used to treat night blindness, elephantiasis, impotency and snake bite. It also causes temporary sterility in women and is applied locally on piles, ulcers, tumors and dropsy. Seed of *B. monosperma* is used in inflammation, skin and eye diseases, bleeding piles, urinary stones, abdominal troubles, intestinal worms and tumor. When seeds are pounded with lemon juice and applied to the skin, they act as a Rubefacient [5, 8, 25]. Stem bark of this plant exhibits various pharmacological properties like, astringent, styptic, aphrodisiac, and anti-inflammatory [25]. *Butea monosperma* is useful as an indigenous medicine for the treatment of anorexia, dyspepsia, diarrhea, dysentery, hemorrhoids, intestinal worms, hepatopathy, ulcers, tumors, hydrocele and diabetes [5, 26]; Bark decoction is useful for cold, cough and catarrh. Its various parts exhibit diverse range of medicinal properties [5].

Research Studies

Anti-inflammatory activity

In *in vitro* study anti-inflammatory mechanism of a hydroethanolic extract of *B. monosperma* flowers (BME) and more specifically of an enriched fraction in butrin and isobutrin (BI) was studied using cell culture of Normal Human Keratinocyte, cells involved in the skin inflammation. Results obtained revealed that hydroalcoholic *B. monosperma* flower extract was able to decrease the secretion of IL-1 β , IL-6 and IL-8 pro-inflammatory cytokines of -32, -33 and -18% respectively. Prostaglandin E2 production and the secretion of MMP-1, -2, -9 and -10 were also inhibited. Same results were observed in presence of enriched fraction in butrin and isobutrin and confirmed the involvement of these molecules in the anti-inflammatory activity of *Butea monosperma* [27]. A case study by Ansari *et al.*, 2019 reported that Hot and moist fomentation with *Gul-i-Tesu* (Butea flower) with oral use of *Habb Suranjān* is found effective in joints pain and knee osteoarthritis without any side effect [28]. Another study conducted (Ansari *et al.*, 2017) to evaluate chondroprotective effect of hydromethanolic extract of *Butea monosperma* (Lam.) flowers (BME) standardized to the concentration of Butein on human Osteo Arthritis (OA) chondrocytes stimulated with IL-1 β reported that hydromethanolic extract of *Butea monosperma* (Lam.) flowers (BME) has strong potential to activate autophagy and suppress IL-1 β induced expression of IL-6 and MMP-3, -9 and -13 in human OA chondrocytes [29].

Antidiarrheal and antimicrobial activity

The ethanolic extract of stem bark of *B. monosperma* has been evaluated for its antidiarrheal potential in Wistar albino rats. The extract inhibited castor oil induced diarrhea and PGE2 induced enteropooling in rats; it also reduced gastrointestinal motility after charcoal meal administration. The results observed establish the efficacy and substantiate the use of this herbal remedy as a non-specific treatment for diarrhea [30]. Methanol soluble fraction of the flowers of *B. monosperma* showed antimicrobial activity against various fungal species due to presence of a bioactive flavone glycoside [31]. In another *in vitro* study antimicrobial efficiency of seed oil of *B. monosperma* was studied by the filter paper disk method against several human pathogenic bacteria and fungi. The oil showed a significant bactericidal and fungicidal effect [32].

The petroleum and ethyl acetate extracts of the stem bark from *B. monosperma* displayed antifungal activity against *Cladosporium cladosporioides* and the antifungal activity of stem bark extracts was found to be greater than that of Benlate (standard fungicide) [33,34]. Another study (Sharma et al., 2019) revealed antibacterial and antidiarrheal effect of Aqueous extract of *B. monosperma* bark (BMAqE) against newly isolated gram negative pathogenic bacterial strain *Enterobacter cloacae* and castor oil induced diarrhea in albino rats using bacterial growth kinetic study, fluorescence spectroscopy, outer and inner membrane permeability assay, dehydrogenase inhibitory assay and protein leakage assay followed by field emission scanning electron microscope (FE-SEM) study and followed by histopathology studies of rat ileum. These effects are found due to active phytoconstituents mostly flavonoids and polyphenols present in the bark of *Butea monosperma* [35].

Pippali rasayana, an Ayurvedic herbal medicine, prepared from *Piper longum* and *B. monosperma*, prescribed for the treatment of chronic dysentery and worm infestations was tested for antigiardial and immunostimulatory activity in mice, infected with *Giardia lamblia* trophozoites. It produced up to 98% recovery from the infection, Enhancement of host resistance could be one of the possible mechanisms contributing towards the recovery of animals from the Giardial infection [36].

Anthelmintic activity:

Iqbal et al., reported that seeds of *B. monosperma* administered as crude powder at doses of 1, 2 and 3 g/kg to sheep naturally infected with mixed species of

gastrointestinal nematodes exhibited a dose and a time-dependent anthelmintic effect. The maximum reduction of 78.4% in eggs per gram of feces (EPG) was recorded on day 10 after treatment with 3 g/kg whereas Levamisole (7.5 mg/kg), a standard anthelmintic agent, exhibited 99.1% reduction in EPG [37]. Another study (Prashanth et al., 2001) reported that methanol extract of *B. monosperma* seeds, tested *in vitro*, showed significant anthelmintic activity [38].

Hepatoprotective Activity

A study conducted by Ahmad et al., reported hepatoprotective effect of flower of *Butea monosperma* (BM) in Paracetamol induced hepato-toxicity in rabbits. Oral administration of BM flowers powder (100 mg/kg) effectively inhibited paracetamol induced changes in the serum marker enzymes, Aspartate Transaminase (AST), Alanine Transaminase (ALT) and Alkaline Phosphatase (ALP) [13].

Another study conducted (Sehrawat et al., 2006) on Wistar rats also revealed that the methanolic extract of *Butea monosperma* (BM) possesses hepatoprotective effects. The alcoholic extract of BM used in the study seemed to offer dose-dependent protection and maintained the structural integrity of hepatic cells and also it might suppress the promotion stage via inhibition of oxidative stress and poly-amine biosynthetic pathway [39]. Butein is an important ingredient of the flower extract of *Butea monosperma* which contributes towards its free radical scavenging, antioxidant and anti-apoptotic properties. The Butein content of *B. monosperma* preparations seems to be crucial for its beneficial effects against hepatic disorders [40]. Butrin and Isobutrin are responsible for hepatoprotective effect of flower of *B. monosperma* [41].

Chemopreventive activity

The chemopreventive effect of *B. monosperma* extract was studied on hepatic carcinogenesis and on tumor promoter induced markers and oxidative stress in male Wistar rats. Treatment of male Wistar rats for five consecutive days with 2-AAF i.p. induced significant hepatic toxicity, oxidative stress and hyperproliferation. Pretreatment of *B. monosperma* extract (100 and 200 mg/kg body weight) prevented oxidative stress by restoring the levels of antioxidant enzymes and also prevented toxicity at both doses [42].

Chemopreventive effects of the aqueous and methanolic extracts of *B. monosperma* in rodent models of hepatic injury and hepatocellular carcinoma as well as flavonoid and triterpenes are found active against different strains

of bacteria as well as many human cancer cell lines as reported by Choedon *et al.*, 2010 [43] and Sharma and Shukla, 2011 [44]. Another *in vitro* study reported anti-cancer action of flower extract of *Butea monosperma* on human breast cancer cell line [45].

Antihyperglycemic activity

A study reported that Ethanol extract of the flowers at a dose of 200 mg/kg exhibited significant reductions in blood glucose, serum cholesterol and improved glucose tolerance, high density lipoprotein (HDL)-cholesterol and albumin levels in alloxan-induced diabetic rats. Single dose treatment of ethanolic extract of *B. monosperma* (200 mg/kg, p.o.) significantly improved glucose tolerance and caused reduction in blood glucose level in alloxan-induced diabetic rats. Repeated oral treatment with ethanolic extract of *B. monosperma* (200 mg/kg/day) for 2 weeks significantly reduced blood glucose, serum cholesterol and improved HDL cholesterol and albumin as compared to diabetic control group [46]. In a study conducted by Deore *et al.*, (2007) has reported that the crude aqueous extracts of the *Butea* bark exhibited significant hypoglycemic and antihyperglycemic effects in normal and alloxan-induced diabetic albino rats, respectively [47]. Study conducted by Bavarva *et al.* (2008) reported that oral administration of the ethanol extract of the seeds exhibited significant antidiabetic effect in noninsulin dependent diabetes mellitus (NIDDM) rats [48]. But another study conducted by Ahmed *et al.*, (2012) to evaluate the antidiabetic effect of aqueous extracts of *B. monosperma* leaves and bark in streptozotocin-induced severely diabetic rats and reported that both leaf and bark extracts of *B. m monosperma* produced insignificant antihyperglycemic activity. The leaf and bark extracts reduced blood glucose to an extent of 28% and 11%, respectively and did not improve pancreatic architecture as reflected by the histopathologic studies [49].

Anticonvulsant activity

The ethanolic extracts of leaves of *Albizzia lebbeck* and flowers of *Hibiscus rosa sinesis* and the petroleum ether extract of flowers of *Butea monosperma* studied foanticconvulsant activity. The bioassay guided fractionation indicated that the anticonvulsant activity lies in the methanolic fraction of chloroform soluble part of ethanolic extract of the leaves of *A. lebbeck*, acetone soluble part of ethanolic extract of *H. rosa sinesis* flowers and acetone soluble part of petroleum ether extract of *B. monosperma* flowers. The fractions protected animals from maximum electro shock, electrical kindling and pentylenetetrazole-induced convulsions in mice. The fractions also inhibited

convulsions induced by lithium-pilocarpine and electrical kindling but failed to protect animals from strychnine-induced convulsions. The fractions raised brain contents of gamma-aminobutyric acid (GABA) and serotonin. These fractions were found to be anxiogenic and general depressant of central nervous system [50]. In another study, the anticonvulsant activity of the crude methanol stem extract of *Butea monosperma* and its bioactive compound has been reported in Swiss albino mice using the Maximal electroshock (MES) convulsion and the Pentylenetetrazole (PTZ) induced convulsion models. The study also suggested its use in the treatment of epilepsy [51]. As per another study, it shows anticonvulsive activity due to the presence of a triterpene [52].

CONCLUSION

From the above review it can be concluded that *Dhāk* (*Butea monosperma*) is an important and useful drug. It has variety of actions and used as a single entity or with other drugs in compound formulation in various ailments. As per Unani literature, each part of the plant has its own temperament and action and used to treat various diseases. It is effective in backache, flatulence, diarrhea, premature ejaculation, haemorrhoids, helminthiasis, vaginal discharge, gonorrhea, ammenorrhoea, dysuria, anuria, cystitis, orchitis, oophoritis, joint's pain, brain disorder and skin diseases as a single drug or in combination. It balances humours and removes morbid matter from the body and promotes health especially its gum in promotion of women's health. Its anticancer, antitumor, anticancer and chemopreventive activities suggest that it can be used in the treatment of carcinoma without destroying normal healthy cells. Due to its proven anti-inflammatory, antimicrobial, hepatoprotective, antioxidant, antidiarrheal activity, it can be used in arthritis, diarrhea and hepatic diseases. It has several bioactive secondary metabolites which are responsible for its various actions. There is a need to explore its more actions through animal studies. The validated claims in animal studies may be further authenticated by clinical trials to confirm it. Central Council of Unani Medicine has done the standardization of its flower and seed which may help in identification genuine medicinal plant and to prevent adulteration. As Unani system has holistic approach and whole body is treated as a unit whole plant or its part is used in natural/crude form because body can digest, metabolize and retain natural ingredients easily and the drug cures disease without producing adverse effects. Moreover, plants are storehouse of molecules that act as

lead structures for new drug development and none other new drug discovery approaches can replace the importance of plants in this direction.

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