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Phytochemistry, Chromatographic Screening, and Pharmacological Activity of Butea Monosperma

Rajarshi Nath[1], Dr. Preeti Mangala[2], Dr. Mohit Kotnala[3]*, Dr. Ravindra Chandrakant Sutar[4], Dr.Bhagaban Biswal[5], Lokesh Kumar Mahato[6], Suprava Sahu[7], Mr. Sagar Narendra Ande[8]

[1]Assistant Professor, Department of Pharmactical Chemistry, Baharat Technology, Ulubeia, Howrah & JIS University, 81, Nilgunj Rd, Jagarata Pally, Deshpriya Nagar, Agarpara, Kolkata, West Bengal. 700109

[2]Associate Professor, Head of Department of Chemistry, Jyoti Nivas College Autonomous, Koramangala, Hosur Road, Bangalore, Karnataka. 560 095

[3]*Science Teacher at Bloom Charter Education, Ain Al Fayedah School-6021 Abu Dhabi United Arab Emirates.

[4]Associate Professor & HOD Department of Pharmacology, SRES'S Sanjivani College of Pharmaceutical Education and Research, Sahajanandnagar, Shingnapur, Kopargaon, Ahmednagar, Maharashtra. 423603

[5]Professor, Department of Pharmaceutics, Om Sai College of Pharmacy & Health Sciences, Sai Vihar, Near Haldia Padar NH-16, Berhampur, Ganjam, Odisha. 760003

[6]Assistant Professor, Department of Pharmacology, Dr. Ambekar Institute of Pharmaceutical Science, Jabaghat, Rourkela. 769042

[7]Assistant Professor, Department of Pharmaceutical Analysis, Dr. Ambekar Institute of Pharmaceutical Science, Jabaghat, Rourkela. 769042

[8]Associate Professor, Dr. Rajendra Gode Institute of Pharmacy, University Mardi road, Amravati, Maharashtra. 444603

*Corresponding Author: Dr. Mohit Kotnala

*Science Teacher at Bloom Charter Education, Ain Al Fayedah School-6021 Abu Dhabi United Arab Emirates.

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KEYWORDS

Butea monosperma, Nephroprotective, Ethanolic Extract, phytochemicals ect.

ABSTRACT:

In order to assess the antistress, antibacterial, antidiarrheal, anthelmintic, anti-inflammatory, anti-hepatotoxic, and wound-healing properties of the phytoconstitute of portions of Butea monosperma (Lam.) with ethanol. The powdered leaves of the plant were extracted with ethanol in multiple steps; the resulting extract had a strong smell and contained the necessary phytochemicals (flavonoids, tannins, and phenols). The ethanolic extract of B.monosperma was subjected to a battery of qualitative chemical analysesTesting results indicated the presence of flavonoids, phenolics, tannins, reducing sugars, saponins, and phenolics. Only the ethanolic extract and the saponins were the subjects of additional phytochemical and pharmacological investigation, based on the findings of these qualitative analyses.

Introduction

Parasitic worm infections and helminthiasis can affect humans and this parasites enter humans through the skin or gastrointestinal tract (GIT) in their immature forms, which then develop into fully developed adult worms with distinct tissue distribution [1]. Anthelminthics are medications that can work systemically to destroy adult helminthes or development forms that infiltrate organs and tissues, or locally to remove worms from the gastrointestinal tract. The majority of anthelminthics on the market now cause adverse effects include diarrhoea, vomiting, nausea, head discomfort, and abdominal pain [2]. Since there are currently no effective immunisations to prevent helminth infections, chemotherapy is the only available treatment and tool for curing and controlling helminth infection. Synthetic anthelmintics should not be used carelessly as this may cause parasite resistance. Herbal medicines have been used for centuries to treat human parasite infections, and they may be useful in halting the emergence of resistance. Butea monosperma, sometimes called black termeric or Kali

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haldi, is a plant that grows abundantly in tropical and subtropical regions [3,4]. Its varied applications are documented in India's ancient history, and it also has a significant impact on Ayurvedic or natural herbal remedies. The plant has been linked to various health benefits, including analgesic, hypoglycemic, hepatoprotective, immunostimulant, anti-inflammatory, antibacterial, antimicrobial, antifungal, antiviral, antiparasitic, antidermatophytic, antioxidant, antifertility, tuberculostatic, and anticancer properties [5]. It is today regarded as a valuable source of distinctive natural goods for the creation of industrial products as well as medications to treat a variety of illnesses. Although Butea monosperma has long been claimed to be an anthelmintic, this has not been confirmed scientifically[6]. For this reason, the current study was designed to assess the ethyl acetate extract of Butea monosperma's anthelmintic activity in vitro.

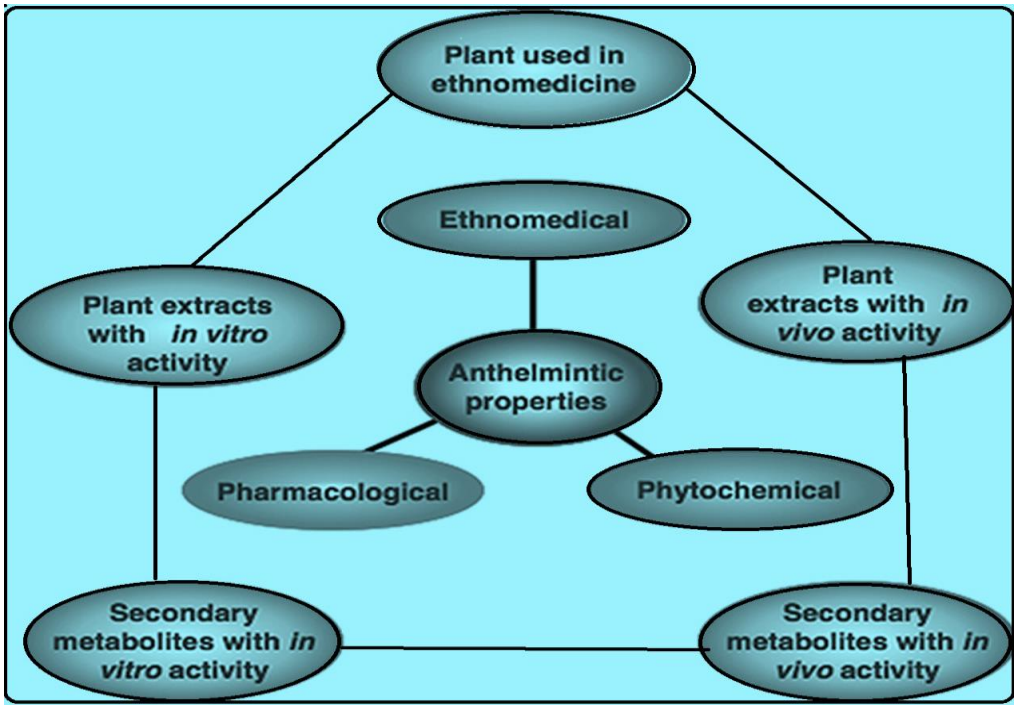

Fig.1 Flow diagram showing the anthelmintic properties of plant used in ethnomedicine[7]

Description of plant profile of Butea monosperma (Lam.)[8]

However, Butea monosperma (Lam.) (Syn. Butea frondosa; Family Fabaceae) is also known as 'Flame of Forest', palash, mutthuga, bijasneha, khakara, chichara, Bastard teak, and Bengal kino. It is believed to be 'dhak' or 'palas'.(Refer). Butea monosperma (Fabaceae), also known as Palash and "Flame of the Forest," is a tree that grows abundantly over most of India, Pakistan, and Sri Lanka. Indian pensula values this tree for its general and therapeutic religious uses[9,10].It is a medium-sized deciduous tree that thrives all over India, with the exception of extremely dry areas. Bark, leaves, flowers, seeds, gum, and other parts are used. Their 630 genera and 18,000 species make them of the largest plant groups with flowers.

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Fig.2 Identification of the plant Butea monosperma based on the portion of its leaves[11]

Butea monosperma is a small to medium-sized deciduous tree that may grow to a height of up to 20 meters. Its trunk is typically twisted and tortuous, and its rough, fibrous bark, which reveals a reddish exudate, is greyish-brown. The branchlets of the tree are highly pubescent. Leaflets are more or less leathery, lateral ones are obliquely oval, and the terminal leaflet is rhomboid-obovate, measuring 12-27 x 10-26 cm, obtuse, rounded or emarginate at apex, rounded to cuneate at base, with 7-8 pairs of lateral veins, stipellate. The leaves are trifoliate [12].

The calyx has four short lobes and a campanulate tube; the corolla is 5–7 cm long, standard, with recurved wings and a keel that are all about the same length; the flowers are bright orange-red, rarely yellow, and heavily pubescent. The flowers are found in racemes, 5–40 cm long, toward the top on branchlets that are primarily leafless. an indehiscent fruiting pod, 17–24 x (minimum 3) in size. 4-6 centimeters, flat in the lower portion, and, when ripe, pale yellowish-brown or gray. A solitary seed is toward the apex, stalked, and covered with tiny brown hairs. A flattened, round seed that is around 3 cm long. oleic and linoleic acid-containing kino-oil, glucose, lignoceric acid, and palmitic acid.Moreover, it has an aromatic hydroxy molecule, glucose, glycine, and an amino glycoside called aglycon.[13].With the exception of extremely acrid regions, Burma and Ceylon stretch into the north-western Himalayas as far as Jhelum. Butea monosperma is commonly used as a diuretic, aphrodisiac, tonic, and astringent. Roots can help with tumours, pile, helminthiasis, night blindness, and ulcers. It is said to have analgesic, aphrodisiac, and antifertility properties. Flowers are astringent, diuretic, depurative, and tonic; they are helpful in diarrhoea. In traditional medicine, the stem bark is used to cure snake bites, ulcers, dyspepsia, diarrhoea, and dysentery. It works best as a laxative, aphrodisiac, and appetiser against helminths.[14]

Thin layer chromatography (TLC) is an analytical technique wherein a liquid mobile phase is let to flow across the plate's surface while the stationary phase, a finely split solid, is applied as a thin layer on a stiff supporting plate[15]. While this technology lacks the separation efficiencies found with gas or high-pressure liquid chromatography, it does have the benefits of simplicity, speed, and variety. Therefore, this paper presents its medico-historical features. The present study aimed to evaluate the nephroprotective ability of the ethanolic extract of Butea monosperma and furnish empirical support for the assertions put out by the indigenous group [16].

Materials and Methods[17]

Plant

The gift sample of Butea monosperma was confirmed by the Department of Crop and Herbal Physiology at the Jawaharlal Nehru Krishi Vishwavidyalaya in

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Jabalpur, Madhya Pradesh. November saw the collection of Butea monosperma, which were then dried in the shade. To prepare the extract, Butea monosperma was coarsely ground and utilized.

Preparation of ethanolic extract of Butea monosperma(Lam.)[18]

First, use activated charcoal to remove the chlorophyll from the powdered plant material, and then let it dry. The thirty grammes of plant material were ground coarsely and then defatted using petroleum ether. The marc that was produced after ethanol was extracted from petroleum ether using a Soxhlet system. To accomplish full extraction, the extraction was carried out over the course of six to seven days. Ultimately, the extract was pressure-dried at 40°C and kept at 4°C until needed. Physical characteristics of the drug extracts, including consistency, colour, odour, and taste, were assessed. the existence of desired phytochemicals, such as tannin and flavonoids. Qualitative chemical analyses were performed on the Butea monosperma ethanolic extract. The test results indicated the presence of flavonoids, phenolics, saponins, reducing sugars, and carbs.

Preliminary phytochemical investigation of Butea monosperma(Lam.)[19,20]

In order to qualitatively identify the phytochemical elements contained in each extract and conduct tests using established procedures, Butea monosperma leaf ethanolic extracts were used for the initial phytochemical analyses. Analytical grade reagents and chemicals were all utilized. Only the ethanolic extracts and saponins were subjected to additional phytochemical and pharmacological research based on the results of all the qualitative tests conducted in each extract.

Table 1. Organoleptic properties of crude drug powder

Plant	Nature	Color	Odour	Texture
Butea monosperma (Lam.)	Uneven texture	Shade of dark green	fragrant	Brutal

Table 2. Physical properties of Butea monosperma extracts (Lam.)

Type of Extract	Consistency Of Extract	Extract Color	Extract Odor	Extractive value (%w/w)
Petroleum ether Ethanolic	Semi- Solid	Green	Characteristic	8.5%
extract Direct)	Semi- Solid	Light Brown	Pungent	10.1%

Table 3. Ethanolic extract of Butea monosperma was subjected to qualitative chemical testing. [21]

Phytoconstitutents	Ethanolic extract
Flavonoids	+
Saponins	++
Alkaloids	+
Glycosides	_
Phenols/Tannins	+
Fixed oil/Fats	+
Gums & Mucilage	+
Carbohydrates	_
Amino acids	_
Steroids	+

+ = Present - = Absent

Chromatographic investigation of the extracts of *Butea monosperma*(Lam.)[22]

The solvent system was filled into a rectangular glass chromatographic chamber until it reached a depth of 0.5 cm. To guarantee appropriate saturation, a piece of filter

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paper was placed within the chamber. Using a capillary tube, the extract spots were placed to a silica gel-G plate. Two locations were retained at a spacing of roughly 2.0 cm apart. Following the application and subsequent drying of the spots at ambient temperature, the plate was cautiously put into the glass chamber. The plate was held at a about 15° inclination to the vertical. After developing the chromatogram, the solvent front moved to a distance of roughly 10.0 cm. After removing the plate, the solvent front was noted. The plate was subjected to air drying prior to its examination under UV light or treatment with the suitable detecting reagent and colored spots were labeled, and the retention factor (Rf) value for each separated component was calculated. The combinations with the best resolution were chloroform-acetone-formic acid (75:16.5:8.5) and acetone-water-conc. ammonia (90:7:3). There were eight stains on the TLC plate that was inspected in the sunlight. The same plates were derivatized using ferric chloride soln. and anisaldehyde-sulphuric acid reagent, but only one of these spraying reagents demonstrated acceptable spot resolution; hence, only solar light detection was selected for additional research because it displayed the best resolution. Before the ideal solvent system was discovered, a great deal of other solvent systems were studied, but none of them produced a good separation or a satisfactory resolution. However, even with the best solvent selected, the spots' resolution was not as clear.

Table 4. The chromatographic analysis of Butea monosperma (Lam.) yielded the following results.

Compound obtain	Type of Extract	Number of Spots	Rf value
Alkaloidal content	Ethyl alcohol	3	0.12, 0.35
	Water	2	0.40
Cardiac Glycoside (Sterol) or Steroidal Glycoside	Ethyl alcohol	3	0.30, 0.53
	Water	3	0.44, 0.31.
Content of Terpenoids	Ethyl alcohol	3	0.24, 0.31.
	Water	2	--
Flavonoids moiety	Ethyl alcohol	2	0.58
	Water	1	--

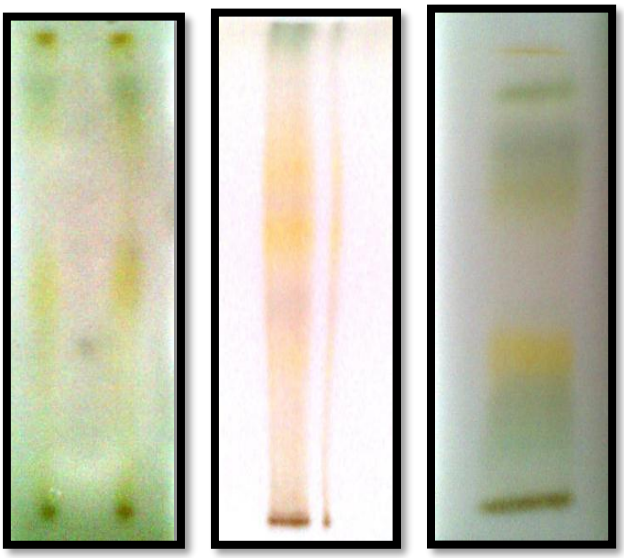

Fig.3 Photograph showing a number of spot in B. monosperma leaves extract

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Pharmacological screening of the plant Butea monosperma(Lam.)[23]

Experimentalanimals

Indian adult earthworms (Pheretima posthumad) were utilized in all of the trials. They were taken from damp soil, cleaned of all faecal matter, and then treated with normal saline. because of its physiological and anatomical similarities to the human intestinal roundworm parasite Ascaris lumbricoids. Earthworms are readily available, hence they are frequently utilized for the initial in vitro assessment of anthelmintic substances.

Preparation of Extracts of Butea monosperma leaves extract[24]

The leaves of Butea monosperma (Lam.) were collected and dried in a shaded area. Subsequently, they were crushed using an electric blender to obtain a powdered form. The powdered leaves were then exposed to extraction using a soxhlet apparatus. The weight-to-weight percent yield of the ethyl acetate extract was determined to be 7.7%. The extracts were subjected to evaporation at ambient temperature in order to concentrate them, and thereafter employed for pharmacological investigations.

The administration of Albendazole

preparation of Albendazole (15mg/ml) involved the utilization of 0.2% v/v of Tween 80 as a suspending agent.

ExperimentalDesign for anthelmintic activities of Butea monosperma(Lam.)[25,26]

For anthelmintic activity, adult Indian earthworms (Pheretima posthumad) were obtained from moist soil and thoroughly cleaned with normal saline to eliminate all faecal matter. Using 0.2% v/v of Tween 80 as a suspending agent, different concentrations (25–75 mg/ml) of Butea monosperma ethyl acetate extract were prepared, with a final volume of 10 ml for each concentration of Butea monosperma. The standard was 15 mg/ml of albendazole. With a few minor adjustments, the anthelmintic assay was performed using the methodology of Ajaiyeoba et al. (2001). The animals were split up into six groups, each with six earthworms and varying extract concentrations and standard medication solutions added to separate Petri dishes. The duration required for the worms to reach a state of paralysis, defined as their inability to revive in a standard saline solution, as well as the time it took for them to expire, ascertained through observations of their lack of movement when vigorously shaken or immersed in warm water (at a temperature of 500 °C), and the eventual fading of their body colors. Each group's four animals' mean ±S.E.M. was used to express all the results. One-way analysis of variance (ANOVA) was used for the statistical analysis, and the student's t test came next. The determination of significance was based on p-values that were found to be less than 0.001, with a confidence interval of 95%.

Anthelmintic effect of Butea monosperma(Lam.) in Indian adult earthworms (Pheretima posthumad) [27,28]

In order to assess anthelmintic activity Group I and II of Butea monosperma (Limb) Rhizome were given normal saline and standard albendazole, whereas groups III, IV, and V, VI were given varying concentrations of Butea monosperma ethyl acetate extract.

Table 5. Anthelmintic Potency of Butea monosperma(Lam.)

Drug/Treatment	Different Group	Concentration mg/ml	Time of paralysis(min) (Mean±S.E.M)	Time of paralysis(min) (Mean±S.E.M)
NormalSaline(Control)	I	-----	-----	-----
Albendazole	II	15	24.18±0.70	78.21±0.23
Ethylacetate extract of Butea monosperma (Lam.)	III	200	60.57±0.63	170.20±1.41
	IV	400	51.13±0.63	138.88±0.68
	V	800	28.86±0.51	120.68±1.32

Each group has six members, and all values indicate Mean ± SEM. Values deviate significantly (***p<0.001) from the albendazole reference standard. It took concentration to do this task. It was discovered that the potency was negatively correlated with the worms' times to paralysis and death.

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Fig.4 Photograph showing AnthelminticPotencyofButea monosperma (Lam.)[29]

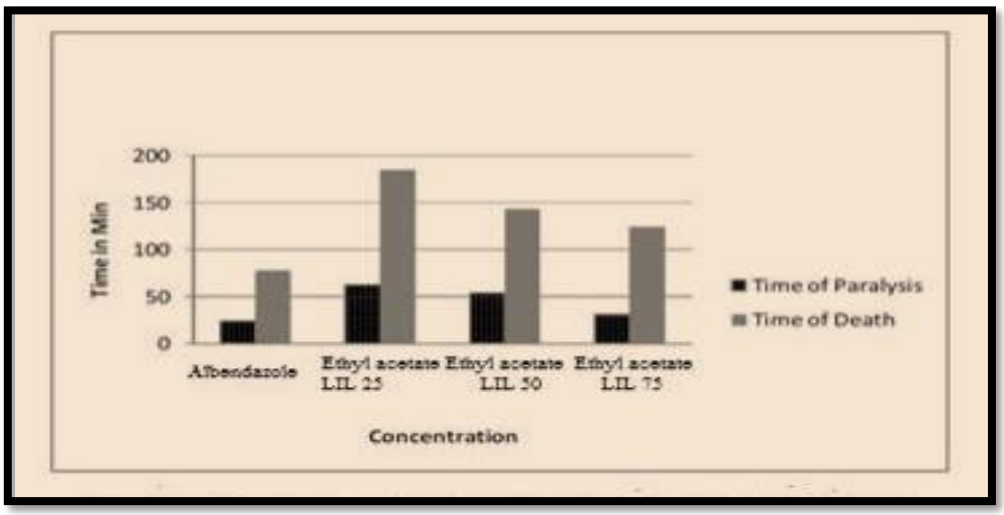

Fig.5 Bargraph showing Anthelmintic Potency of Butea monosperma (Lam.)[30]

Results and Discussion

Following shade drying, the plant was powdered and sent to an organoleptic evaluation. The drug's powdered form had a pale green hue, a strong fragrance, and a gritty texture. Following this, 30 g of the drug's powder was weighed and directly extracted using ethanol using a Soxhlet device. After computation, the extraction value was discovered to be 10.1%. Physical aspects of the extract, such as colour, consistency, and smell, were further investigated. Subsequent phytochemical and pharmacological analyses were carried out on the ethanolic extract in response to the outcomes of the comprehensive qualitative chemical tests performed on said extract, since the ethanolic extract demonstrated the presence of several required phytochemicals.The drug's ethanolic extract was chromatographed on TLC plates, with acetone-water-conc. ammonia (90:7:3) and chloroform-acetone-formic acid (75:16.5:8.5) yielding the greatest resolution. There were eight stains on the TLC plate that was inspected in the sunlight. The plates were subjected to derivatization using ferric chloride solution and anisaldehyde-sulphuric acid reagent. However, neither of these spraying reagents exhibited satisfactory resolution of the spots. Consequently, sunlight detection, which displayed the highest resolution, was chosen for further investigation. The

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findings indicate that, in comparison to albendazole, Butea monosperma (Lam.) ethyl acetate extracts have dose-dependent anthelmintic action. Based on the data, it has been confirmed that Butea monosperma is an anthelmintic because it showed activity against the worm employed in this study. It was discovered that the potency was negatively correlated with the worms' times to paralysis and death. The current data do not support any theory about the mechanism of Butea monosperma (Lam.) anthelmintic activity. Nonetheless, it might be because of how it inhibit parasites' absorption of glucose and reduces their production of glycogen. Additionally, Butea monosperma (Lam.) may have caused the worms' prolonged depolarization or hyperpolarization by activating the nicotinic cholinergic receptor.

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