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Research Article

Pharmacognostical Studies on *Butea monosperma* (Lam.) Taub (Faboideae) Flower

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Abstract

Butea monosperma, a deciduous tree belonging to the family Faboideae, is found growing in many parts of India. All the parts of plant are highly medicinal with its mention in different systems of medicine. Several review works have summarized the potential efficiency of this plant. This Pharmacognostic study comprises taxonomic details, macro and microscopic characters, physico- chemical details and study of phytochemical components of all five successive extracts. The work is done for pharmacognostic standardization and authentication of flowers of *Butea monosperma.*

1. INTRODUCTION

Butea monosperma (Lam.) Taub (Syn. *Butea frondosa* Willd. Family Faboideae), a deciduous tree, is found chiefly in the mixed or dry deciduous forests of Central and Western India. This plant is popularly known as dhak or palas, palash, mutthuga, bijasneha, khakara, chichara and commonly known as 'Flame of the forest'. This tree grows to 50 ft high, with stunning flower clusters. Tree is almost leafless during spring season forming an orange- red hue of flowers on the upper portion, giving the appearance of flame from a distance [1,2].

B. monosperma is extensively used in Ayurveda, Unani, Homeopathy and Traditional systems of medicine. Flowers of *B. monosperma* are used as anticonvulsant, antioxidant, antistress, antigout, diuretic, antileprotic, anti-inflammatory, antiulcer, astringent, antiestrogenic activity, antihepatotoxic, eye disorder [2,3], diarrhea[4], depurative, tonic, leprosy, skin diseases and thirst[5]. Phytochemical studies of flower extract have shown chemical constituents like triterpene, flavonoids and glycosides like butein, butin, isobutrin, coreopsin, isocoreopsin, sulphurein, monospermoside, isomonospermoside, chalcones, aurones and steroids[6,7,8].

Each plant drug possesses unique properties in terms of its botany, chemical constituents and therapeutic potency. So it is important to study pharmacognostic characters of each medicinal plant to differentiate the genuine plant sample. Isolation and pharmacological studies have been extensively made on all parts of *B. monospema* but, very less is known about pharmacognosy. Present work is to frame a standard Pharmacognostic parameters for the flowers of *Butea monosperma* useful in authentification and standardization of the drug, which can guarantee the quality and purity of the drug.

2. MATERIALS AND METHODS

2.1 Plant material

Flowers of *B. monosperma* were collected from the Halligeri village, Dharwad District, Karnataka. The plant was authentically identified using Flora of Karnataka[9]. The recent name has been given based on IPNI[10]. Herbarium specimen (Voucher specimen number: KUD/BOT/2012/10) was prepared and deposited in Department of Botany, Karnatak University, Dharwad, along with powder samples (KUD/BOT/2012/10) for future reference study.

The collected flowers were cleaned and shade dried. Fresh samples were used for anatomical studies and dried parts were powdered, sieved and stored in an airtight container for further use.

2.2 Macroscopic and microscopic analysis

Key morphological features were observed for easy identification. Microscopic studies were carried out by using dissecting microscope (AJAY® OPTIK INDI: AJ-2. CM/L-9018771). Powder studies were carried out by using reagents and stains like iodine, potassium iodide, ferric chloride, Sudan III, ruthenium red and phloroglucinol with Con. HCl (1:1) [11,12,13]. Safranin (4%) and toludine blue were used to double stain the transverse sections [11,14]. All the reagents of analytical grade were procured from Hi-Media, Mumbai, India. Organoleptic characters like colour, texture, odor and taste were determined for flower powder [11].

2.3 Photo documentation

Photomicrographs of free hand sections and powder microscopy were taken using compound binocular microscope at different magnifications (Carl Zeiss Axio Imager M_2 model) with inbuilt analogue camera (ProgRess C5- JENOPTIK). Computer images were captured using ProgRes® CapturePro 2.8- JENOPTIK optical system software.

2.4 Physico-chemical analysis

Physico-chemical parameters of the powdered drug such as total ash, water-soluble ash, acid-insoluble ash and sulphated ash were determined. Extractive value, solubility tests, moisture test, mineral content and nutritive value (ash, fat, fiber, protein and carbohydrate) of flowers were determined as per standard procedures[15,16]. Foaming index, bulk and tapped density, hausner ratio and carr index, swelling index, moisture sorption capacity, pH and hydration capacity of the powder sample[13,17] were studied.

2.5 Calculation of % carbohydrate and nutritive value

Percentage of carbohydrate was calculated by the following formula:

% carbohydrates = 100 - (Percentage of ash + percentage of moisture + percentage of fat + percentage of protein)

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Nutritive value was finally determined by:
Nutritive value = 4 x percentage of protein + 9 x percentage of fat + 4 x percentage of carbohydrate

2.6 Fluorescence analysis
The treated powdered sample materials of flower were analyzed under visible light, short ultra-violet light (254nm) and long ultra-violet light (365nm)[18].

2.7 Preparation of extracts and preliminary phytochemical analysis
The powdered material was serially extracted by Soxhlet extraction method using hexane, chloroform, acetone, ethanol and water. These extracts were subjected for preliminary phytochemical screening [19].

2.8 Data analysis
Standard deviation is calculated as mean of three replicates for flower constants and physico-chemical parameters using SPSS version 16.0, statistical package. Data is represented in table-1.

3. RESULTS

3.1 Macroscopic characters of flower
Flowers large, in rigid racemes, up to 15 cm long, 3 flowers together form the tumid nodes of the dark olive-green velvety rachis; pedicels as long as the calyx, densely brown-velvety; bracts and bracteoles small, deciduous (Plate 1. Fig. A, B and D). Calyx 1.3 cm long, dark olive- green, densely velvety outside, clothed with silky hairs within; teeth short, the 2 upper connate, the 3 lower equal, deltoid. Corolla 3-5 cm long, clothed outside with silky silvery hairs, orange or salmon coloured; standard 2.5 cm broad; keel semicircular, beaked, veined. Stamens 10, monoadelphous, basifixed glabrous filament. Ovary superior, style hairy, stigma globular hairy and monocarpellary unilocular.

3.2 Anatomical characters of Flower
Olive green coloured calyx section shows oval shaped epidermal cells subtended by brownish unicellular trichomes, oil ducts and internally 6-7 layered cortical cells (Plate 1. Fig. C, E and F). Corolla shows uni and pitted like multicellular trichomes (Plate 2. Fig. G, H), multilayered parenchyma cells with orange yellow pigments (Plate 2. Fig. I) followed by conjoint, collateral vascular bundle (Plate 2. Fig. J). Inner ovary section shows outer unicellular trichomes (Plate 2. Fig. L), multilayered cortical cells followed by conjoint, collateral and closed vascular bundle (Plate 2. Fig. K, M).
Powder microscopy showed uni and multi cellular trichomes of calyx and corolla. Numerous orange yellow pigmented cells, oil globules, triangular and oval shaped pollens were observed.

3.3 Organoleptic characters
Powder is yellowish brown, velvety in texture, bitter in taste and smells chocolaty.

3.4 Physicochemical parameters
Physicochemical characters such as ash value, mineral content and nutritive value indicated the amount of inorganic constituents (Table 2). Yield is calculated using soluble extractive value and extractive value. Foaming index, bulk and tapped density, hausner ratio, carr index, swelling index, hydration capacity, moisture sorption capacity helps to know moisture content and deterioration time. The pH of sample was slightly basic (Table 1)

3.5 Fluorescence analysis
Consistency, color and fluorescence activity of powdered drug observed at 254, 365nm and visible light are given in Table 3.

3.6 Phytochemical analysis
The extractive value for successive extracts taken in hexane, chloroform, acetone, alcohol and water were calculated (Table 1). The extract showed sticky nature for all solvents and color difference in visible light (Table 1). All the extracts were subjected to preliminary phytochemical screening and the results certified the presence of alkaloids, phenols, flavonoids, triterpinoids, steroids, carbohydrates, proteins and saponins in alcohol and water extracts of flower.

Table 1: Physicochemical observations of *B. monosperma* flower

Parameter	
1. Ash Value (% w/w):	
Total ash	2.50 ± 0.02
Acid insoluble ash	1.98 ± 0.01
Water soluble ash	0.78 ± 0.01
Sulphated ash	3.47 ± 0.03
2. Extractive value (% w/w):	
Hexane	0.78 ± 0.02 (dark yellowish to orange)
Chloroform	0.59 ± 0.01 (orange)
Acetone	2.11 ± 0.02 (Dark orange)
Alcohol	0.55 ± 0.03 (dark orange)
Water	17.15 ± 0.13 (brownish yellow)
3. Solubility Test (% w/w):	
Alcohol	0.60 ± 0.02
Water	1.26 ± 0.01
4. Nutritive content (%)	
Ash	2.50 ± 0.02
Moisture	2.00 ± 0.02
Fat	3.14 ± 0.00
Fiber	2.10 ± 0.01
Protein	16.87 ± 0.01
Carbohydrate	75.11 ± 0.01
5. Nutritive value in cal./100 g powder	396.21
6. Foaming index	< 100
7. Swelling index %	46
8. Bulk and Tapped density g/ml	0.55
9. Moisture sorption capacity/g	1.39
10. Hydration capacity g/g	2.309
11. Hausner ratio	1.00
12. Carr index %	20
13. pH	7.69

Table 2: Mineral content in flowers of *B. monosperma*

Mineral content	N %	P %	K %	Na %	S %	Ca %	Mg %	Fe ppm	Mn ppm	Zn ppm	Cu ppm
quantity	2.7	0.27	1.98	0.06	0.1	1.02	0.42	132.83	21.47	68.58	18.18

Table 3: Ultra- violet powder analysis of flowers of *B. monosperma* at 245 and 365 nm

Treatment	Visible light	U. V. light at 254nm	U.V. Light 365nm
	Flower	Flower	Flower
Powder + NaOH (Aqueous)	Apache yellow	Door country green	Door country green
Powder + NaOH (Alcoholic)	International red	Door country green	Light green
Powder + 1N HCl	Canary yellow	Apple green	Apple green
Powder + 50% H_2SO_4	International orange	Apple green	Apple green
Powder + 50% HNO_3	Canary yellow	Light yellow	Chrome yellow
Powder + Lead acetate + NaOH	International red	Green	Brown
Powder + HNO_3	Canary yellow	Light yellow	Light yellow
Powder + acetic acid	Canary yellow	Apple green	Apple green
Powder + $FeCl_3$	Brown	Green	Green
Powder + HNO_3 + NH_3	International red	Green	Green
Powder + H_2SO_4	Orange	Door country green	Door country green
Powder + Pet. Ether	Beige color	Light green	Light almond
Powder + Methanol	Canary yellow	Light green	Light almond
Powder + Water	Canary yellow	Light green	Light almond
Powder + Benzene	Canary yellow	Light green	Light almond
Powder + Glycerin	Canary yellow	Light green	Light almond

4. DISCUSSION

Plants are treasures of medicine. When the plant sounds strong traditional significance they are exploited to study their efficacy. Review works by various authors[1,3,5,6,7,8] have documented the uses of *B. monosperma* in different systems of medicine. Their study helped to know the detailed chemical constituents of drug part and potency of plants in pharmacological field, with relevant references. The documented compounds belong to triterpenoids, steroids, carbohydrates, proteins and flavonoids. Present pharmacognostic study of *B. monosperma* flower is supportive to know the basic characters of the drug like detailed anatomy, physico-chemical parameters, phytochemical constituents, mineral and nutritive value. Some salient features of *B. monosperma* flowers studied using pharmacognostic features are discussed in this paper.

A pigmented bright orange yellow parenchyma cell and pitted multicellular trichomes are salient feature of the drug. Humidity in the sample and extract decides the deterioration time. High water content in powder and aqueous extract are found to get deteriorated due to fungal attack. Loss in weight of flower powder on drying at 105^0 C was found to be 2.00 %. Analytical results like total ash value was 2.50% which indicate the amount of minerals present in the flower sample. The amount of acid-insoluble siliceous matter was higher than water-soluble ash (1.98%). Compared to solublility value, extractive value of water was higher. Foaming index indicated the presence of saponins in sample. Less value of hausner ratio, carr index, bulk and tapped density indicated good flow. Positive results for alkaloids, saponins and phenols indicate the need of further studies regarding isolation and characterization of these active principle constituents.

5. CONCLUSION

The parameters studied can be utilized in identification of *Butea monosperma* in crude drug form and can be used as a potential source for useful therapeutics. The resulted data will be beneficial for quantitative and qualitative standardization of genuine drug in herbal preparations. Positive result for alkaloids, saponins and phenols is indicative of scope for future analysis.

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REFERENCES

1. Geeta R, Prakash R, et al "*Butea monosperma* (LAM.) KUNTZE: A Review" *Int Res J of Pharma*, 2011, 2 (7):98-108.
2. Varsha S, "Therapeutic Significance of *Butea monosperma*: A Review" *J of Drug Delivery & Therapeutics*, 2011, 1(2): 63-67.
3. Rana F, Avijit M, "Review On *Butea monosperma*" *Int J of Res in Pharma and Chemistry*, 2012, 2(4): 1035-39.
4. Malpani MO, Rajput PR, et al "Phytochemical Screening, Characterization and *In Vitro* Antimicrobial Activity of *Butea monosperma* Flower, Leaves and Gum: Methanolic and Aqueous Extract "*Int J of Chemistry Res*" 2012, 3(1): 17-20.
5. Parashar B, Dhamija HK "Botanical, Phytochemical and Biological Investigation of *Butea monoaperma* (LAM.) KUNTZE" *Pharmacology online*, 2011, 3: 192-208.
6. Sindhia VR, Bairwa R, "Plant Review: *Butea monosperma*" *Int J of Pharmaceutical and Clinical Res,* 2010, 2(2): 90-94.
7. Mazumder PM, Das MK, et al "Butea Monosperma (Lam.) Kuntze" Int *J of Pharmaceutical Sci and Nanotechnology*, 2011, 4(2): 1390- 93.
8. Pal P, Bose S, "Phytopharmacological and Phytochemical Review of *Butea monosperma*" *Int J of Res in Pharmaceutical and Biomedical Sci*, 2011, 2(3):1374-88.
9. Saldana CJ, Flora of Karnataka, Vol. 1, Oxford and IBH Publishers, New Delhi. 1984.
10. IPNI. The International Plant Names Index. /www.ipni.orgS (accessed 23.03.12).
11. Khandelwal KR, Practical Pharmacognosy, Nirali Publication, Pune, 2007, 10-14.
12. Johansen DA, Plant microtechnique, McGraw Hill, New York. 1940, 182.
13. World Health Organization, Quality control methods for medicinal plants, AITBS publishers, New Delhi, 2002, 10-11.
14. Krishnamurthy KV, Methods in plant histochemistry, V Subramanian for S Vishwanath Private Ltd, Madras, 1988.
15. Pharmacopoeia of India, Government of India, Ministry of Health, Volume II, Controller of Publication, New Delhi, 1996, A-52, A-54.
16. Indrayan AK, Sharma S, et al "Determination of nutritive value and analysis of mineral elements for some medicinally valued plants from Uttaranchal" *Current Sci*, 2005, 89(7): 1252-55.
17. Terangpi R, Basumatary R "Pharmacognostic and Physicochemical evaluation of stembark of *Acacia pennata (*L.) Willd., a folk plant of the Dimasa tribe of Assam" *J of Pharmacognosy and Phytochemistry*, 2013, 2(2) 134-40.
18. Kokoshi CJ, Kokoshi RJ, et al "Fluorescence of powdered vegetable drugs under ultraviolet radiation" *J Pharm Sci*, 1958, 47: 715-717.
19. Harborne JB, Phytochemical Methods; A guide to modern techniques of plant analysis, Chapman & Hall, London, 1973,182 -189.