

SHORT COMMUNICATION

Phenetic analysis and phytochemical screening of medicinally important *Albizia* spp. in Sri Lanka

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ABSTRACT

Albizia Durazz. is a genus of 150 species in the tropics and subtropics of the world and belongs to the sub family Mimosaceae in the Family Fabaceae. Of the six species recorded in Sri Lanka, *A. lebbeck* is used as a shady tree while *A. odoratissima* is grown mainly for their timber value. However, *A. odoratissima* and *A. lebbeck* are found to be used in ayurvedic medicine however, the medicinal properties of these species are not fully understood. A questionnaire survey was carried out using a hundred sample population to identify their medicinal usage. Floral and vegetative characters of the above two *Albizia* spp. were observed and phenetic relationships were identified. Air dried stem barks of *A. odoratissima* and *A. lebbeck* were subjected to sequential solvent extraction using hexane, chloroform, methanol and water, and the crude weight of the yield were obtained. The results revealed that ayurvedic physicians and traditional ayurvedic medical practitioners use *A. odoratissima* in medicinal preparations whereas the medicinal use of *A. lebbeck* is not reported. Further, it was revealed that *Samanea saman* and *Adenanthera pavonina* are commonly used as substitutes for *A. lebbeck*. Knowledge of phenetic variation of the two *Albizia* spp. can be used for accurate identification which prevents adulteration. Highest yield was obtained from the methanolic extracts. These extracts were subjected to preliminary phytochemical screening to assess the occurrence of different phytochemicals. Results have shown the presence of glycosides, tannins, phenolics, phytosteroids and flavonoids in methanolic extracts *A. odoratissima*, and *A. lebbeck*. The present study suggests that further studies should be conducted on the identification of active compounds in these two plant species for their pharmacognostic properties in order to understand their mode of remedial action for ailments.

Keywords: *Albizia* spp., phenetic variations, phytochemical screening, bark extracts.

INTRODUCTION

Plant derived medicines are used to control many human diseases and are gaining popularity in both rural and urban areas because of the effectiveness, safety and affordability. Plant formulations are known to be used throughout the history of humanity and they have a respectable position especially in developing countries where Western medicine is not popular.

Albizia Durazz. is a genus that contains approximately 150 species distributed in the tropics and subtropics of the world and belongs to Sub Family Mimosaceae in the Family Fabaceae (Dassanayake, 1980). Six species of *Albizia* are recorded in Sri Lanka; *A. amara*, *A. odoratissima*, *A. chinensis*, *A. lebbeck*, *A. falcataria* and *A. lankaensis* Dassanayake, 1980). Among these species *A. odoratissima* and *A. lebbeck* are known to be used in ayurvedic medicine in Sri Lanka and India (Ayurveda pharmacopeia, 1979). Even

though many plants have been used as raw material in various medicinal preparations, their taxonomic information and medicinal properties have not been explored systematically (Li *et al.*, 2009; Hall and Nazir, 2005). Similarly, medicinal importance of *Albizia* spp. have been reported (Ayurveda pharmacopeia, 1979) and due to the lack of the knowledge in the distribution and inaccurate identification *Samanea saman* [Paremara (S)] and *Adenathera pavonina* [Madatiya (S)] are used as substitutes to *A. lebbeck*.

Albizia lebbeck [Hewan Mara (S)] is native to tropical southern Asia and widely cultivated and naturalized in other tropical and subtropical regions in the world. In Sri Lanka, the species is found in the dry zone as a roadside tree. The height of the plant varies from 18-30 m with a trunk 50cm to 1m in diameter. Its uses include environmental management, forage, medicine and wood. It is cultivated as a shade tree in North and South America. *A. lebbeck* is used as for respiratory tract

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diseases, abdominal tumors, gingivitis and bark is used to treat inflammation. (Lowry *et al.*, 1994). Different parts of *A. lebbeck* are used to treat various diseases in Ayurveda medicine as poly herbal formula such as, juice of flowers for hiccough and asthma, paste of bark for skin diseases, juices of plant parts for worm infestation, powder of plant parts for obesity, seeds for wounds and headache, for poisoning and insect bites (Sharma, 1996). Chemical constituents present in different plant parts of *A. lebbeck* possessed many pharmacological properties and uses *viz.* antibacterial, antifungal, hypotensive, hypoglycaemic, anticancer, bronchodilator and in tropical eosinophilia (Central council for research 1996, Chopra, 1956).

Albizia odoratissima [Huri Mara (S)] is a large tree growing up to 20m height, distributed in India, Sri Lanka and Nepal. In Sri Lanka it is used to produce timber and found in intermediate zone as home garden tree as well as roadside tree. Whole plant parts of *Albizia odoratissima* are used for anxiety and depression. The flower heads are used as oxytocic, anthelmintic, digestive sedative and diuretic and for insomnia. The stem is used for analgesic, stimulant, swelling, injuries, abscesses, diuretics, anthelmintic and diabetes (Narayandas, 2003, Kirtikar, 2006, Rajan *et al.*, 2011). Therefore, to explore the possibility of developing a system for applications of these plants in curing diseases, a systematic and extensive investigation in their medicinal properties is needed.

Phytochemicals are naturally occurring bioactive compounds present in plants for their characteristic odor, flavor, smell and texture, which can be used as remedy for many diseases, including cancer and cardiovascular diseases and to inhibit pathogenic microorganisms (Renu, 2005). The most important bioactive constituents of plants are alkaloids, tannins, flavonoids, steroids, terpenoids, carbohydrates and phenolic compounds (Pascaline *et al.*, 2011). Therefore, present study was aimed to evaluate the phenetic variation of *Albizia* spp. and in preliminary identification of phytochemical groups present in these plants.

MATERIALS AND METHODS

Socio-economic survey

A structured questionnaire survey was carried out to determine the uses and distribution of *A. lebbeck* and its substitute plants during the period of February to October 2010 using a convenience population sample of 100 representing ayurvedic physicians, traditional ayurvedic practitioners, drug suppliers, drug manufacturers and general public.

Morphometric Study

Morphological characters were examined during the period of November 2010 to November 2011 and specimens were collected from their natural habitats. Specimens of *A. odoratissima* were collected from Wellawaya of Monaragala district, Ampitiya in Kandy district while *A. lebbeck* from Sewanagala of Monaragala district. They were identified against authenticated specimens at National Herbarium Peradeniya. Morphometric analysis was carried out considering seventeen structural characters of seedlings, leaves, barks, flowers, pods and seeds.

Phytochemical Studies

Stem bark of *A. odoratissima* and *A. lebbeck* were shade dried and powdered using mechanical grinder (Disk mill, stc 23, China). Powdered stem barks of each plant (1 kg) were subjected to sequential solvent extraction using hexane (2L), chloroform (2L) and methanol (2L) after keeping overnight in the shaker (Orbital shaker, Lab-Line, UK) separately. Each extract was filtered and the solvent was removed using a rotary evaporator (Buchi, R-114, Switzerland) and the yield of each crude extract was recorded.

Powdered stem bark of *A. odoratissima* (250g) and *A. lebbeck* (250g) were mixed with 750ml of distilled water separately and kept in the shaker overnight. The filtrate of each plant was freeze dried using the freeze drier (Labconco, cat.01, Missouri), and the weight of the crude was recorded.

Stock solution of each extract (1% w/v) was prepared using an appropriate solvent (hexane/chloroform/ methanol/water). The extracts obtained were subjected to preliminary phytochemical screening using the standard procedures (Harbone, 1998, Khandelwal, 2008, Rajan *et al.*, 2011). Extracts were subjected to screening tests for carbohydrates, proteins, amino acids, alkaloids, flavonoids, glycosides, tannins, phenolics, phytosteroids and saponins.

RESULTS AND DISCUSSION

Use of the species by local people

Questionnaire survey revealed that *A. odoratissima* and *A. lebbeck* are not commonly used in Sri Lanka for the preparation of therapeutic systems due to their restricted distribution despite that *A. odoratissima* is commonly used as a timber tree. According to the findings of the survey 62 % of general public are unaware about the medicinal value of these plants. The medicinal uses of *A. odoratissima* were known only by 15% Ayurvedic physicians while 35 % of the ayurvedic practitioners were aware of the uses of *A. lebbeck*

in therapeutic systems. Around 17% of drug suppliers use *A. odoratissima* as a substitute for *A. lebbbeck* and this is mainly due to their ignorance on the distribution and availability of the species in Sri Lanka. Both these species are restricted to the dry zone and are not used in the herbal drug market.

This study also revealed that *A. lebbbeck* is substituted by *Adenanthera pavonina* (S-Madatiya) (9%) and *Samanea saman* (S-Paremara) (21%) in the ayurvedic medicine. This study further reveals that around 6% of drug manufacturers was aware about *A. odoratissima* but *A. lebbbeck* is not widely known. The ethnobotanical study conducted in this study will inspire the utilization of these two plant species in practices of ayurvedic medicine in Sri Lanka. The identified localities of *A. odoratissima* and *A. lebbbeck* in selected districts in Sri Lanka.

Morphometric Study

Variations of stem bark, type of inflorescence, colour of flowers and shape, appearance and colour of the pods are recognized as important diagnostic characters for the identification of the two species precisely (Table 1, Figure 1).

Phytochemical Study

Crude weights of the plant extracts are presented in Table 2. The highest yield was obtained from methanolic extract of stem bark of *A. odoratissima*

and *A. lebbbeck*. In the present study successive extraction method with different solvents of increasing polarity from a non-polar (hexane) to a polar solvent (methanol) was used to ensure the extraction of compounds of a wide polarity range.

Results of the preliminary phytochemical screening revealed that carbohydrates, proteins, amino acids, glycosides, alkaloids, phytosteroids, flavonoids, saponins, tannins and phenolic compounds were present in all the methanolic extracts (Table 3) while none of the phyto-chemical constituents were present in hexane extracts of stem barks of both species. Pattern of occurrence of different phytochemicals in solvent extracts of *A. odoratissima* and *A. lebbbeck* stem barks confirm both species have similarity in their chemical composition (Table 3). Presence of carbohydrates, proteins, amino acids, steroids, glycosides, alkaloids, flavonoids, tannins, phenolics and fixed oils in leaves of *A. odoratissima* was also reported in the preliminary phytochemical screening carried out by Rajan *et. al.* in 2011.

Alkaloids are known as effective phytoconstituents associated to their sedative properties and powerful effect on the nervous system (Renu, 2005). Hence the presence of alkaloids in stem barks of *A. odoratissima* and *A. lebbbeck* supported the use of the stem barks in preparation of pain relief herbal preparations.

Table 1. Comparison of phenetic characters of the two *Albizia* spp.

Character	Character state	
	<i>Albizia lebbbeck</i>	<i>Albizia odoratissima</i>
Habitat	Terrestrial	Terrestrial
Plant form	Woody	Woody
Leaf type	Compound	Compound
Leaf pattern	Bipinnate, leaflets paired with no terminal	Bipinnate, leaflets paired with no terminal oval gland near rachis base.
Trunk – bark characters	Bark smooth to fissured, grey; Internal bark (IB) pink W,s – whitish, h-light yellow, coarse -grained	Bark smooth, yellowish grey, soft; IB – light red with white marbling; young parts tomentose
Flower	Inflorescence	Inflorescence
Type of Inflorescence	Axillary heads, several, together	Spadix head like globose heads 3 – 6 clustered at nodes
Colour of flowers	Cream, fragrant, clustered	Greenish white, sessile
Fruit	Flat legumes	Strap – shaped legumes
Colour of pod	Straw colored	Red brown
Appearance of pod	Flat thin	Flat, thin, oblong
Length of pod	21 cm	19 cm
Width of pod	4 cm	4 cm
Number Of seeds	7 - 10	7 – 12
Colour of seeds	Dark brown	Greenish brown (dark brown)
Shape of seeds	Oval	Oval
Seeds arrangement	Marginal	Marginal

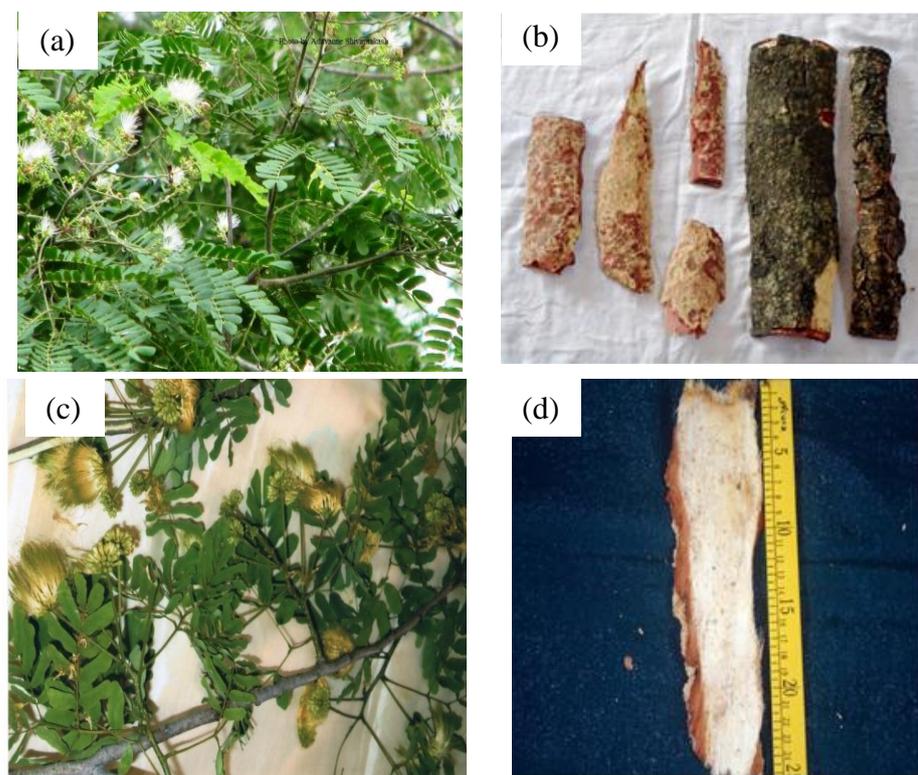


Figure 1. - Flowers and stem barks of *A. odoratissima* [(a) and (b)] and *A. lebeck* [(c) and (d)]

Table 2. Crude weights of stem bark extracts of *Albizia* Spp.

Solvent	Crude Weight (gram)	
	<i>Albizia odoratissima</i>	<i>Albizia lebeck</i>
Hexane	0.1157	0.534
Chloroform	0.2365	1.364
Methanol	53.4216	230.088
Water	1.691	1.521

Table 3. Qualitative phytochemical analysis of stem bark extracts of *Albizia odoratissima* and *Albizia lebeck*

Secondary metabolite	<i>Albizia odoratissima</i>		<i>Albizia lebeck</i>	
	Methanol	Water	Methanol	Water
Flavonoids	+	+	+	+
Glycosides	+	-	+	-
Tannins and Phenolic compounds	+	+	+	+
Phyto steroids	+	-	+	-
Saponins	+	+	+	+

Presence of flavonoids in methanol and aqueous extracts of these *Albizia* species suggested the possibility of developing antioxidant agents.

Steroidal compounds are of highly important and interested in drug discovery programmes. Presence of tannins in both methanolic and aqueous extracts of these species is a valuable finding in pharmaceutical industry as saponins are known to be having numerous pharmacological properties (Estrada *et al.*, 2000). Saponin is a key ingredient

in traditional Chinese medicine and is responsible for many of the attributed biological effects (Liu, 2002, Li, 2009).

Concluding remarks

The information gathered from the questionnaire survey, with respect to the uses and distribution of two *Albizia* species in Sri Lanka, have shown that the limited distribution of *A. lebeck* has restricted the use in medicinal preparations while *A. odoratissima* is widely known for its timber value.

Due to the lack of available knowledge in taxonomic identification of these two species the substitution is seems to be common. Present morphometric study can provide the systematic knowledge in accurate identification of the medicinally important two *Albizia* species present in Sri Lanka. Findings of the preliminary phytochemical evaluation will enhance the understanding of the potential active ingredients present in the stem barks of these two species. Further, phytochemical similarity of these two species supports the use of both plants in preparations of therapeutic systems. The knowledge gathered in the present study can be disseminated to the users through conducting awareness programmes.

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