

A comprehensive ethno-pharmacological review on *Lippia alba* M

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Abstract: The present comprehensive review was conducted in the Department of Biotechnology and Genetic Engineering of Islamic University, Kushtia, to pile up update ethno-pharmacological information of *Lippia alba* (Mill) that is available in different scientific literatures. *L. alba*, belongs to the family of verbenaceae, found everywhere in Bangladesh and it is commonly used in folk medicine to treat gastric illnesses, diarrhea, fever, asthma, malaria, and inflammation. Phytochemical analysis showed that the crude extract of fresh leaves consists of some valuable essential oils and that is found to be effective against bacteria, fungus, protozoa, and virus. The present paper also covers the taxonomy, morphology, monograph, usable parts, and distribution of this valuable medicinal plant.

Keywords: *Lippia Alba*, Ethno-Pharmacological, Folk Medicine, Phytochemical Analysis

1. Introduction

Long before mankind discovered the existence of microbes, the idea that certain plants had healing potential, indeed, that they contained what we would currently characterize as antimicrobial principles, was well accepted. Since antiquity, man has used plants to treat common infectious diseases and some of these traditional medicine are still included as part of the habitual treatment of various maladies [1-3]. Over the past 20 years, there has been an increased interest in the investigation of natural materials as sources of new antibacterial agents. In the recent years, the development of resistance of pathogens against antibiotics has become a difficult issue caused by the indiscriminate use of modern antibiotics [4]. Considering the high cost of the synthetic drugs and their side effects, wide varieties of natural plants can be considered as a vital source for anti-microbial agents [4]. Therefore, the demand for new and effective anti-microbial agents with broad-spectrum of activity from natural sources is increasing day by day [4].

Lippia alba (Mill.) N.E. Brown, also known as *Lippia geminata* HBK or *Lantana alba* (Mill), was one of the first two plants from overseas departments to be approved by the French Drug Agency (AFSSaPS) for inclusion in the French Pharmacopeia [5] is a shrub about 3 m tall that belongs to the

Verbenaceae family [6, 3] and it is abundantly present between the south of the USA, the north of Argentina, Bangladesh [4] and also present in India [7] and Australia [8]. In the traditional medicine of Brazil the species *L. alba* is used as a remedy for stomach disorders [9-11], antibacterial and antiseptic for infectious diseases influenza, measles, rashes, and headaches [11-12]. The plant presents a great morphological and chemical variability that Matos suggested the division into different chemotypes [13, 11]. So far, at least 12 chemotypes have been described: citral [13,11], linalool [14, 11], carvone [13, 11], limonene [15, 11], γ -terpinene [16, 11], citral-myrcene [14, 11], citral-limonene [14, 11], citral- β -caryophyllene [17, 11], citral-germacrene-D [18, 11], carvonelimonene [14, 11], 1,8-cineol-camphor [19, 11], 1,8-cineollimonene [18, 11], limonene-piperitone [20, 11]. GC analyses of essential oils from *L. alba* revealed the predominance of monoterpene type compounds such as citral, β -myrcene, limonene and carvone [20, 11].

The purpose of this review was the documentation and to compare the chemical composition, pharmacological aspects and traditional uses which have been identified in the literature concerning to *L. alba* species, in order to uncovering records of other compounds, new flavoring substances and their relationships.

1.1. Taxonomy of *L. alba*

Medicinal plants are classified according to the part used, habit, habitat, therapeutic value etc., besides the usual botanical classification. But the botanical classification is the most comprehensive and scientific classification. The botanical classification of *L. alba* is as following:

Kingdom	<i>Plantae</i> -Plants
Division	<i>Magnoliophyta</i> -Flowering plants
Class	<i>Magnoliopsida</i> -Dicotyledons
Order	<i>Lamiales</i>
Family	<i>Verbenaceae</i> -Verbena family
Genus	<i>Lippia</i>
Species	<i>Lippia alba</i> (Mill.) [21]

1.2. Synonyms

Its common names include Bushy Matgrass [21], Bushy *Lippia*, and Hierba Negra. Bangali name is Motmote.

1.3. Plant Parts Used

Bushy *Lippia* is widely cultivated as an ornamental for its aromatic foliage and beautiful flowers [22]. The leaves have many medicinal uses and are also used for flavoring foods [23]. Leaves are used as an infusion against states of excitement, hypertension, digestive troubles, nausea and cold, to heal wounds locally and as syrup against cough and bronchitis. An infusion of the roots is also used against bad colds and coughs [24, 4]. Besides, the leaves from the majority of these species are utilized as seasoning for food preparations [25, 12].

1.4. Monograph

Bengali name	Motmote
English name	Bushy Matgrass
Scientific name	<i>Lippia alba</i> (Mill.)
Family	<i>Verbenaceae</i>
Duration	Perennial
Growth habit	Multi-branched shrub
Bang: nativity	Native

1.5. Morphology

It is a shrub, with a quadrangular branch, reaching 1.7 m in height. The leaves are membranaceous, petiolate, pubescent, opposite or ternate, and its limb shows variable forms with a pointed apex, cuneiform or decumbent basis and serrated or crenated border (except on the basis). The flowers (3-5 mm) are white or pink. The fruit is composed of two indehiscent nucleous, each containing one brown seed [26-28].

1.6. Distribution

L. alba is an aromatic perennial shrub with huge medicinal properties distributed throughout the world. It grows well in Bangladesh, India, Mexico, Paraguay, Brazil, Uruguay, the south of the USA, the north of Argentina and Australia [7, 8, 4].

2. Phytochemistry

The plant contains borneol, camphor β -cubebene, β -elemene, γ -cadinene, allo-aromadendrene and so on. Root powder of plant contains terpenoids, phenylpropanoids and sugar. The chemical constituents of *L. alba* are shown in Table 1.

Table 1 Chemical constituents of *L. alba*

Parts used	Constituents	References
Root powder	Terpenoids, phenylpropanoids, and sugars	[3]
Leaves	Borneol, camphor, 1,8-cineole, citronellol, geranial, linalool, myrcene, neral, piperitone, sabinene, 2-undecanone, α -muurolene, β -caryophyllene, β -cubebene, β -elemene, γ -cadinene, allo-aromadendrene, caryophyllene oxide.	[17, 25, 29, 12]

3. Folk Remedies and Traditional Uses

Leaves are used as an infusion against states of excitement, hypertension, digestive troubles, nausea and cold, to heal wounds locally and as syrup against cough and bronchitis. An infusion of the roots is also used against bad colds and coughs [24]. It is also used as a sedative and also against hypertension, flatulence

and pain [30]. In Itacare, it is used against stomach ache and digestive troubles with high concordance between informants [31]. In a Mixe community, in Mexico, the leaves of *L. alba* were frequently cited by traditional healers as active against gastrointestinal troubles [9]. Various traditional uses of the *L. alba* are mentioned in Table 2.

Table 2 Folk remedies and traditional uses of *L. alba*

Type of use	Symptoms	Part used and method	References
Digestive	Digestive troubles in general	Leaves, infusion	[24]
	Nausea and/or vomiting	Leaves, infusion	[24]
		Leaves, smoking	[32]
	Stomach pain	Leaves	[9]
	Flatulence	Leaves, infusion	[32]
	Diarrhea	n.k.	[33]
Respiratory	Respiratory ailments in general	Leaves infusion or decoction	[34]
	Bronchitis	Leaves, syrup	[24]
	Sore throat	Leaves, infusion	[35]
	Flu	Leaves, infusion	[35]
		Leaves, decoction	[32]
	Cough	Leaves, syrup	[24]
Sedative	Cold	Roots, infusion	[33]
		Leaves, infusion	[24]
		Leaves, infusion	[24]
		Leaves and flowers, infusion or decoction	[34]
Cardiovascular	Hypertension	Leaves	[36]
		Leaves, infusion	[24]
		Leaves, infusion or decoction	[34]
Miscellaneous	Anemia	Leaves	[37]
	Headache	Leaves, poultice	[32]
	Pain	n.k.	[30]
	Skin diseases	Leaves, macerate for washing	[32]
	Wounds	Leaves, local use	[24]

n.k.: not known

4. Pharmacology

Following the folk and traditional uses of the plant, it has been investigated scientifically to validate the potential of

the plant in cure of variety of ailments. Some of the reported pharmacological activities of *L. alba* are mentioned in Table 3.

Table 3 Pharmacological activities of *L. alba*

Pharmacological Activity			References
Ati-infectious properties	Antibacterial activities	Bacilli Gram +	<i>B. subtilis</i> , <i>L. casei</i> , <i>S. lutea</i> [38, 39, 40, 34, 4]
		Cocci Gram +	<i>E. faecalis</i> , <i>M. luteus</i> , <i>S. aureus</i> , <i>S. aureus</i> , <i>S. epidermidis</i> , <i>S. mutans</i> [38, 39, 41, 40, 34]
		Bacilli Gram -	<i>E. aerogenes</i> , <i>E. coli</i> , <i>K. pneumonia</i> , <i>P. aeruginosa</i> , <i>Salmonella sp.</i> , <i>S. marcescens</i> , <i>S. flexneri</i> , <i>S. sonnei</i> , <i>X. campestris</i> [38, 42, 39, 43, 41, 40, 4]
		Mycobacteria	<i>M. smegmatis</i> , <i>M. smegmatis</i> [42, 40]

Effect on the nervous system	Antifungal activities	<i>C. albicans</i> , <i>C. albicans</i> serotype B, <i>C. guilliermondii</i> , <i>C. krusei</i> , <i>C. parapsilosis</i> , <i>C. tropicalis</i> , <i>C. sitophila</i> , <i>C. neoformans</i> T1-444 Serotype A, <i>F. pedrosoi</i> 5VPL, <i>T. rubrum</i> T544	[39, 44, 34, 40]
	Antiviral activity	HSV-1, influenza virus type A (H3N2), poliovirus type 2	[45, 46, 47]
	Antiprotozoal activity	<i>E. histolytica</i> , <i>G. lamblia</i> , <i>T. vaginalis</i> , <i>P. falciparum</i> D-6 clone	[48, 49, 42]
	Neurosedative activity		[50, 51, 52, 53, 54]
	Analgesic and anti-inflammatory activities		[55, 40]
Cardiovascular activity			[56, 57]
Miscellaneous	Antioxidant activity		[58, 59, 54]
	Cytotoxic activity		[60, 40]

5. Toxicological Study

Aguiar, 2006 determined the oral LD50 of *L. alba* extracts, the values being 460 mg/kg for an ethanolic leaf extract and 1466 mg/kg for a chloroformic root extract in mice [40].

6. Discussion

Antibiotics provide the main basis for the therapy of bacterial infections. However, the high genetic variability of bacteria enables them to rapidly evade the action of antibiotics by developing antibiotic resistance. Thus there has been a continuing search for new and more potent antibiotics. According to World Health Report on infectious diseases 2000, overcoming antibiotic resistance is the major issue of the WHO for the next millennium. Hence, the last decade witnessed an increase in the investigations on plants and spices as a sources of human management [61] and more natural antimicrobials has driven scientist to investigate the effectiveness of inhibitory compounds such as extract from plants [62].

Numerous papers have presented ethno-pharmacological studies dealing with *L. alba*. Its leaves are employed as infusion or decoction to the treatment of various digestive problems, gastric illnesses, diarrhea, fever, asthma, cough, cardiovascular and tranquillizing remedy [13, 3]. Large variations have been observed in the composition of *L. alba* essential oil, depending on the part of the plant employed in the distillation, on the plant's state of development and on the geographic location, the characteristics of the soil, climate, and others local conditions [6, 3]. GC analyses of essential oil from three chemotypes of *L. alba* revealed the predominance of monoterpene type compounds such as citral (55.1%), β -myrcene (10.5%), and limonene (1.5%) [13, 3]. The essential oil of *L. alba* showed antimicrobial activity against gram positive microorganisms, in general,

with minimum inhibitory concentration (MIC) between 0.31-0.63 mg/mL [3]. Its extract is active against a large number of both gram positive and gram negative bacteria, fungus, even it is active against several disease causing virus and protozoa (Table 3). It has neurosedative activity, analgesic and anti-inflammatory activities, antioxidant activity, cytotoxic activity (Table 3) too. That means it can be used in a broad range of human health care purpose by identifying the chemicals that posses the medicinal activity and can be used as a potent drug to treat these types of human disease instead of antibiotics which showed much side effects to people.

7. Conclusion

L. alba is a world-wide popular medicinal plant that is considered useful in numerous ailments, mainly digestive, respiratory, sedative, cardiovascular troubles and anxiety. Antitumor potential is the exciting aspects of the plant. The plant is a potent gastro protective too. Several investigators have reported the plant as a valuable antibacterial, antifungal and active against other plant pathogens. Presence of wide range of phytochemicals and pharmacological activity indicates its promise in herbal medicine for multidisciplinary usages. The pharmacological experiments performed in the plant must be extended to the next level of clinical trial to generate novel drugs. This might prove helpful to use its immense therapeutic efficacy as a potent phytomedicine.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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