Lantana camara L.: Exploring Its Ethnobotanical, Phytochemical, Pharmacological, and Toxicological Profiles

Rakesh Kumar [1], Amar Deepak [1], Arvind Sharma [1]
Ravinder Khatri [2], Kamal Jeet [1*],
[1] School of Pharmaceutical and Health Sciences, Career Point University, 176041
[2] Gautam College of Pharmacy, Hamirpur, 177001
Assistant Professor, Department of Pharmacy, Career Point University
Corresponding Author: kamaljeetisf@gmail.com
1 rk3238382@gmail.com
1 amardeepak28@gmail.com
1 arvind.pharmacy@gmail.com
2 khatri.avinder07@gmail.com

Abstract
In the present era, researchers are focusing on medicinal plant research throughout the world as medicinal plants are an important and cheap source of drugs and have a long history. Most of the remedies in the traditional system were taken from plants due to lack of technology, and using plants as medicines were proven to be useful. Lantana camara L. (Verbenaceae) is an aromatic plant as well as a rich source of medicinal compounds. From decades the plant is used to treat many diseases i.e., malaria, fever, cold and cough etc. Several essential phytochemicals have been isolated from L.camara L., including triterpenoids, flavonoids, alkaloids, saponins, steroids, and tannins. Moreover, it is also known as an essential oil-producing plant, and the essential oil is available in the market known as Lantana oils. Thus due to the above mentioned economic as well as medicinal properties of L.camara L; there is a need of a comprehensive report on the ethnobotanical, phytochemical, pharmacological and toxicological aspects of L. camara L. This review will be useful for researchers working in the field of genomics, metabolomics and molecular studies of medicinal plants.

Keywords: Medicinal plant, pharmacological activity, Phytochemical, Lantana camara

1. Introduction
Linnaeus recognized the genus Lantana camara L., which belongs to the family of plants known as Verbenaceae, in the year 1753 as a plant that had medicinal, ornamental, and essential oil-producing properties. Six of its seven species have been discovered in the Americas, while the seventh has been discovered in Ethiopia [1]. Its origins can be traced back to South America, but it is now present in nearly fifty countries throughout the globe, with some of those countries even permitting its production [2]. The plant is commonly used as a decorative element in gardens and is also known as sagebrush and red sage [3]. At elevations of up to two thousand metres, L. camara can be found growing in regions that are classified as either tropical, subtropical, or temperate [4].

There are prickles or spines on the plant, and it has a stem that is made of wood. Additionally, it has flowers that are an assortment of hues, including pink, white, and red [1]. There are a few cultivars that are not connected to the *L.camara* complex, despite the fact that the majority of the 650 cultivars in the genus are related to it. Additionally, it is considered to be an invasive weed on a global scale [5]. The manganese and potassium that are found in L. camara ash are claimed to be beneficial to coconut palms, according to another line of reasoning [2]. There is a lack of evidence to support the claim that this plant is poisonous to both both humans and animals [6,7]. L. camara has been used medicinally for a very long time, and it has been shown to be effective in treating a broad variety of illnesses, such as cancer, tumours, eczema, chickenpox, fevers, rheumatism, asthma, wounds, and tetanus [8,9]. These are some of the major phytochemicals that may be extracted from L.camara: ursolic acid, oleanolic acid, linaroside, lantanoside, verbascoside, camarinic acid, phytol, and umuhengerin. Numerous studies [10,12,13] have been conducted to evaluate their possible biological actions. In addition to this, the plant is well-known for being an excellent and easily accessible source for the extraction of essential oils that are identified as Lantana oils [14]. Significant biological benefits, including anti-inflammatory [16], antioxidant [17], and antibacterial [18] properties, have been shown for these essential oils that are extracted from L.camara from a variety of locales [12,15]. In spite of this, the NCBI Genbank database already has more than 41 sequences, some of which are (rps3, atpB, ccsA, rpoC1, rpoC2, FT, GLO1, rpl32, and rbcL) [19] and, more recently, the genome of L.camara [20]. Because of the economic and medical relevance of L. camara, it is necessary to conduct a comprehensive analysis of its phytochemistry, pharmacology, and toxicity. The findings of this review will serve as the foundation for further molecular research on L.camara.

2. Growth & Description

In tropical, subtropical, and temperate regions, the Lantana camara is the species that is present in the greatest abundance. It may be found growing at elevations of up to 2,000 metres. The name of the species, camara, is most likely derived from the West Indian terminology. Small clumps with a diameter of less than or equal to one metre are the most common appearance of Lantana camara in its natural habitat, which is located in tropical America. Within its naturalised area, Lantana camara often develops dense monospecific thickets that range in height from one to four metres and have a circumference of around one to four metres. A total of over sixty countries have granted naturalisation to the Lantana camara plant. Lantana is still growing its distribution throughout a wide range of countries and islands, including Yap, the Galapagos Islands, Palau, Saipan, Tinian, the Solomon Islands, and Futuna Island, among others. In addition, the plant thrives in environments that are characterised by chaos, such as along the sides of roads, railway tracks, and canals. On the other hand, there is no need to establish a maximum temperature or rainfall restriction. It is impossible for Lantana camara to survive in the dense and unbroken canopies of taller native forest species. Additionally, Lantana camara is vulnerable to frosts, low temperatures, and soils that are high in salt.

3. Phytochemistry

Considering that L. camara is a plant that can be used for medical purposes, every component of the plant was investigated for the presence of chemical compounds. It was discovered that the leaf extracts included the majority of the chemical elements, which included triterpenoids, alkaloids, flavonoids, tannins, saponins, and glycosides [15–24]. Studies on the phytochemical properties of the stem and fruit of L. camara were also carried out [22], in addition to the leaves. Tannins, saponins, flavonoids, and terpenoids were recorded as being present in the stem and fruit of t32.he plant. According to the results of a GC/MS analysis performed on the fruit in an n-hexane fraction [22], the following chemicals were found. It has been stated that the root of the plant contains a significant bioactive chemical known as oleanolic acid, and the process of isolating this compound has been patented [25,26]. Other than that, L.camara is well-known for being an abundant source of essential oils, which may be purchased in the market under the name Lantana oils [14]. The following table provides more information regarding the chemical constituents of essential oils that have been reported from various countries. If we make a comparison between the essential oil composition of Saudi Arabia and the essential oil that has been reported from other countries, it is interesting to note that the composition of essential oils that have been reported from Saudi Arabia is different from that of essential oils reported from other nations. In accordance with what is stated in Table 1, cis-3-hexen-1-ol and 1-hexanol are two of the most important components of L. camara essential oils. These components have been reported for the very first time from Saudi Arabia, and they have not been found in any of the previous research [15]. On top of that, β-caryophyllene, which is a naturally occurring bicyclic sesquiterpene, is an essential molecule that is found in every essential oil composition that has been observed up until this point. Consequently, it is recommended that β-caryophyllene be taken for the purpose of conducting additional research and can be examined as a powerful indicator for essential oils derived from L.camara.

Table.: 1 List of major Constituents of L. camara Essential oil reported from different countries of the word.

S.NO	Countries	Compounds	References
1	Saudi Arabia	Spathulenol, caryophyllene oxide, 1-octen-3-ol, 1-hexanol, β-caryophyllene, spathulenol, c-cadinene, and trans-b-farnesene.	[18]
2	Congo	β-caryophyllene, α-humulene, bicyclogermacrene.	[20]
3	Iran	β-caryophyllene, sabinene, bicyclogermacrene, α-humulene, 1,8 cineole	[22]
4	Cameroon	β-caryophyllene, caryophyllene epoxide II	[24]
5	Algeria	β-caryophyllene, caryophyllene oxide, β-elemene	[28]
6	Madagaskar	β-caryophyllene, davanone, sabinene, linalool, α-humulene	[29]
7	Nigeria	α-humulene, 1,8-cineole, β-caryophyllene, sabinene	[30]
8	South china	β-caryophyllene, α-humulene, germacrene-B, germacrene-D	[18]

9	India	germacrene-D, β-caryophyllene, α-copaene, α-cadinene	[21]
10	Cuba	E-nerolidol, α-humulene, β-caryophyllene	[23]

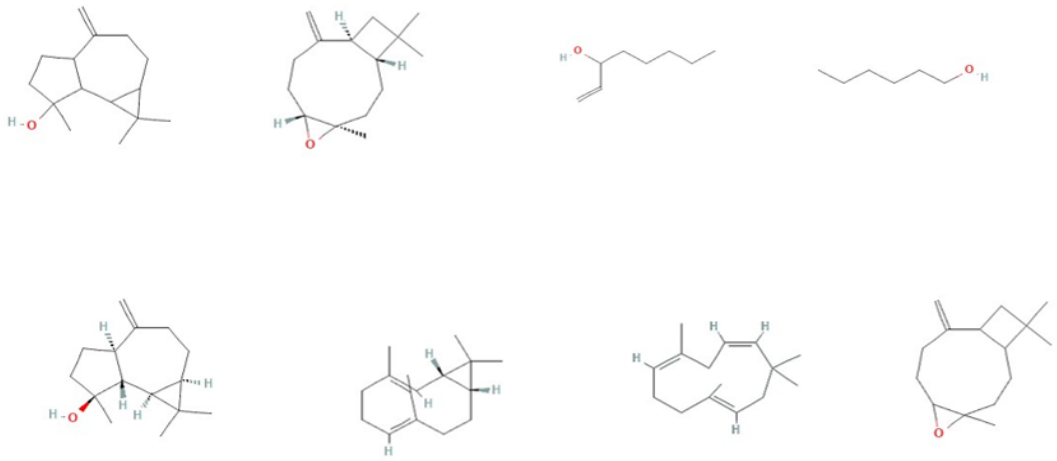

Figure: 1 Chemical Constituents various compound of L. camara Essential oil

4. Pharmacological activity of L. camara

4.1 Antibacterial activity

L. It is possible that the presence of some of these chemical elements, specifically lantadenes and theveside, in the extracts of camara leaves and flowers, which were reported here, is an explanation for the observed effects. Although the exact method by which these chemical elements exert their effects is not yet completely understood, it is abundantly obvious that the efficiency of the extracts is predominantly determined by the kind of solvent that is utilized [6].

4.2 Anti-diabetic activity

Lantana camera L. is a perennial aromatic shrub that may grow up to two to three metres in height and can spread out to a width of approximately two and a half metres. It has been stated that lantana camera is used in traditional medicine for the treatment of rheumatism, rheumatism, itches, wounds, ulcers, swellings, bilious fever, cataracts, and eczema. In accordance with the World Health Organisation (WHO), diabetes mellitus is described as a metabolic condition that can have numerous causes and is characterised by persistent hyperglycemia along with changes in the metabolism of carbohydrates, fats, and proteins. These disturbances are caused by errors in insulin secretion, insulin action, or both. Long-term damage, malfunction, and failure of a number of organs were among the consequences of diabetes mellitus. It is possible for diabetes mellitus to manifest itself with symptoms that are typical of the condition, such as thirst, polyuria, blurred vision, and weight loss.

4.3 Anti-hypertensive

Hypertensive is most common cardio vascular disease and is a major public health issue. Recent study have reported and increasing trend in the prevalence of hypertension in India subcontinent.

This increase was found to be about 30% in urban population and 10% in rural habitants in last three decades [13]. Lantana camara also referred to as “Spanish flag or West Indian Lantana”; and sometimes known as “Red Sage.” L. camara is an “ornamental weed” with aromatic leaves, prange, blue, red, yellow, and bright red flowers, and dark blue and black fruits (drupes) Add more information of hypertensive [26]. L. camara especially the leaves have been used as an anti-tumor, antibacterial, anti-hypertensive agent, tonic, and expectorant whereas the roots are known for the treatment of rheumatism, skin rashes, and malaria [26,27].

4.4 Anti-obesity

Obesity is a chronic metabolic disorder cause by an imbalance between energy intake and expenditure. Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. Obesity is one of the greatest health threats of this century. In the literature survey, it was found that falconoid, sterols, tannins and alkaloids have shown promising effects to tackle obesity by various mechanisms, Lantana camera whole plant has shown the presence of sterols, triterpenoids, flavonoids alkaloids and saponins, and other in the extracts. Moreover, traditional Indian medicines also claims for its anti-obesity activity [14]. Obesity is known to be a social problem and has become the focus of much attention by public and especially health-related institutions, whose aim is to provide as much information as possible to reduce its prevalence. Both statistics and the observation of people that we commonly meet are evidence to the fact that many of these attempts fail. Taking advantage of the strong impact it has on the audience, the mass media have taken hold of this topic, but do not necessarily deal with it with due seriousness; at the same time, food and drug industries continue to propose and advertise new weight-lowering products [28]. Obesity is one of the greatest health threats of this century, which has an important impact on life style-related diseases such as coronary heart disease, dyslipidemia, glucose intolerance, diabetics, hypertension and some cancers (Hu et al., 2008). Several factors, including lack of exercise, sedentary lifestyles and the consumption of energy rich diets are contributory to the etiology of obesity. Despite the urgent need for safe [29]. The aim of the present study was to investigate the anti-obesity effect of a mixture composed of Garcinia cambogia extract, soypeptide, and L-carnitine (1.2:0.3:0.02, w/w/w) in rats rendered obese by a high-fat diet (HFD). Sprague-Dawley rats were fed either the high-fat control diet (CD) or the 0.38% mixture supplemented HFD (CD + M) for 9 weeks. The mixture significantly reduced body weight gain and the accumulation of visceral fat mass in a rat model of HFD-induced obesity. Moreover, the mixture effectively lowered blood and hepatic lipid concentrations and serum glucose, insulin, cpeptide, and leptin levels in rats with HFD-induced obesity.

4.5 Hepatoprotective:

Liver is the biggest reticulum-endothelial organ in the body as such has important immune function in maintaining body integrity. The liver plays an astonishing array of vital function in the continuation, performance and adaptable homeostasis of body. It is concerned with approximately all the biochemical pathway to enlargement, fight in opposite to disease, nutrient contribute, energy stipulation and reproduction. The liver is the largest gland of the body enclosed within the right lower rib cage beneath the diaphragm it is almost completely covered by visceral peritoneum and a dense irregular connective tissue layer that lies deep to the peritoneum. Liver is divided in two principle lobes, a large right lobe and a smaller left lobe separated by falciform ligament.

The right lob is considered by many anatomists to include an inferior quadrate lobe and posterior caudate lobe. Liver has five surfaces as anterior, posterior, superior, inferior, and right [15]. The extract was evaluated for hepato-protective and curative activity against acetaminophen-induced liver injury in mice. Histological examination was also performed and correlated to the biochemical parameters [16].

4.6 Antihemorrhoid activity

Antihemorrhoid activity was carried out on patients using capsules prepared from dry aqueous extract of lantana camera 500 mg/kg. Hemorrhoids / Pills can be describe as masses or clumps (cushions) of tissue within the anal canal that contain blood vessels and their surrounding, supporting tissue made up of muscles and elastic fibers. Selection of patients was done according to their age, sex and dietary habits. Capsules were prescribed for one month, once in a day assessment of subjective and objective parameter were done. Results of anti – hemorrhoidal activity revealed significant reduction in signs and symptoms of acute hemorrhoidal attack (viz. Bleeding, Anal discomfort, anal discharge, swelling and pain at prolapse and proctitis) at last week i.e. on 28^{th} day was found treated in patients.

5. Conclusion

There is a high increase in demand for herbal drugs nowadays. Plants are famous for possessing many chemical moieties with a lot of pharmacological properties. Many powerful and efficient drugs have been isolated from medicinal plants for treating dreadful diseases. Thus it is very clear that the studies of medicinal plants are very significant for the benefits of human beings in terms of manufacturing herbal drugs. Lantana camara is among those vital medicinal plants which have been used as folk medicine globally. Several phytochemical reports showed that the plant is rich in important chemical compounds as well as essential oils. Steroids, coumarin, monoterpenoids, flavonoids, diterpenes, including many other chemical compounds have been reported from L camara. Maximum numbers of the pharmacological investigations carried out on L camara are just preliminary tests on some animal models. These studies are not sufficient in order to develop pharmaceutical products. However, intensive preclinical and clinical research studies are needed for the evaluation of the efficacy and toxicity of these products. Additionally, more research is required for the investigation of the unexplored potential of this important medicinal plant.

Conflict of interest

The authors assert they have no competing interests.

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