REVIEW ARTICLE

Phytochemical and Pharmacological profile of *lanata camara* l: An Overview

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ABSTRACT

Now a day, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems. Over the last few years, researchers have aimed at identifying and validating plant derived substances for the treatment of various diseases. Similarly it has been already proved that various parts of plants such as Leafs, fruits, seeds etc. provide health and nutrition promoting compounds in human diet. *Lanata camara* L. (*Verbenaceae*) some times also known as wild or red sage,is listed as one of the important medicinal plant of the world and it is also considered most noxious weeds. The present review aims to compile medicinal values of *Lanata camara* generated through the research activity using modern scientific approaches and innovative scientific tools.

Keyword: *Lanata camara*, Phytochemical studies, Pharmacological Studies

INTRODUCTION

Lanata camara L. (*Verbenaceae*) some times also known as wild or red sage, is listed as one of the important medicinal plant of the world and it is also considered most noxious weeds. *Lanata camara* is the most widespread species of this genus, growing luxuriantly at elevations up to 2000 m in tropical, sub-tropical and temperate regions. The species name, *camara*, is probably adopted from the West Indian colloquial name for the common species [1].

It is an evergreen aromatic shrub and planted as an ornamental which commonly found around houses of Algeria with four typical colours: yellow-orange, pink-violet, yellow and white flower types. In addition, it is now a highly invasive weed in many parts of the world [2]. *Lantana* is mostly native to subtropical and tropical America, but a few taxa are indigenous to tropical Asia and Africa. It now occurs in approximately 50 countries where several species are cultivated under hundreds of cultivar names. The plant is also documented regionally as camara, camara chumbinho, camara-de-cheiro, camara-deespinho, camara-miudo-de-espinho, camara verdadeiro, camara vermelho, cambara, cambara-de-duas-cores, cambara-de-folhagrande and chumbinho or chumbinho roxo [3]

Some varieties of *L. camara* are toxic for causing photosensitization in ruminants, which kills the animal. Ubiquitously, intoxication only occurs when enough plant material is ingested, particularly when starving animals are conduced to pastures where the plant grows freely, which is frequently in periods of abiotic stress.

Taxonomical Description [4]:

Kingdom : Plantae
Order : Lamiales
Family : Verbenacea
Genus : Lantana
Species : camara

Figure 1: *Lanata camara*

Morphological Description:

Lantana camara (Verbenaceae) is a rambling, prickly-stemmed, hairy, evergreen, wild shrub that can reach a height of about 3 m [5]. It is a woody straggling plant with various flower colours, red, pink, white, yellow and violet with small rounded heads, often in two colours, yellow and red. The stems and branches are

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sometimes armed with prickles or spines. The leaves are arranged in opposite pairs and are broadly oval, rough with short hairs, with finely toothed edges along with a number of veins giving a wrinkled appearance. The fruits are fleshy berries in clusters, shiny and globose in shape, green in colour which on ripening turns to black [6,7].

Therapeutic Uses:

A number of therapeutic uses of various parts of *Lanata camara* have been documented which indicate that *Lanata camara* is being used for treatment of various ailments in many regions of the world since ancient time. It has been documented that root decoction was used to treat stomach ache and vomiting in infants in West Africa. Beside these the same parts of the *Lanata camara* have been used against quinine resistant malaria. At the same time the leaves are also have been used medicinally for treatment of sore throat, cough, conjunctivitis, toothache, skin rashes and itching and the vapor of boiling leaves for headache and cold. In West Africa the leaves have also been used as diaphoretic, stimulant, and treatment of jaundice and rheumatism [8]. In Nigeria and Senegal also *Lanata camara* leaf infusions have been used in management of cough, colds, asthma and pyrexia [9]. In Central and South America and Ghana *Lantana camara* leaves and flowers have been used against fever, influenza and stomach-ache sores, chicken pox and measles high blood pressure. Beside these the plant parts have been employed for the treatment of cancers and tumours. Along with these the therapeutic use of the *Lanata camara* have been documented in treatment of treat cuts, rheumatisms, ulcers, vermifuge, leprosy and scabies in Asian countries. Additionally, the *Lanata camara* have also been used in releaving of gastrointestinal diseases (In Mexico)[10], ENT disorders like cold, cough, tonsillitis, otitis-media (In Kenya) [11], leprosy (In Bangaladesh) [12],diarrhoea (In SouthernWestern Ghats of India)[13]and they rheumatism and pulmonary diseases (in Brazil)[14]. In addition to that *Lanata camara* have also been reported to be used in management of bilious fevers, catarrhal infections, tetanus, atoxy of abdominal viscera[15], memory impairment [16], and as anti-inflammatory, antipyretic, antispasmodic, and antibiotic agent [17]. At the same time use of *Lanata camara* as sudorific, carminative, antiseptic, antispasmodic, antiemetic and insecticide have also been documented.

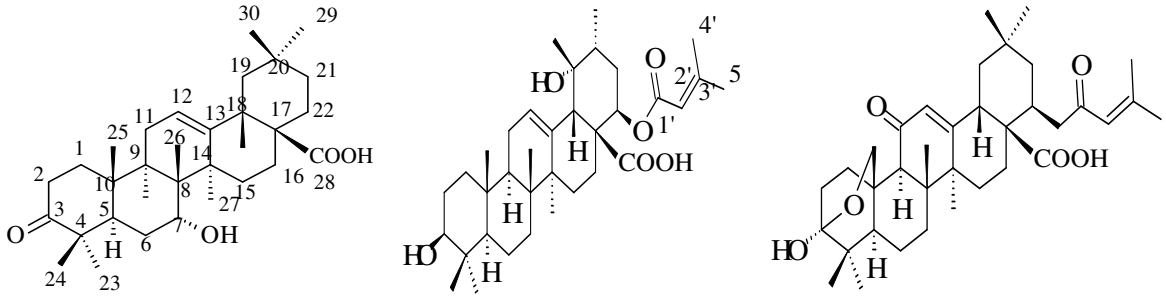
Traditional Uses:

Lanata camara is toxic in nature, hence have been employed as wild pest in many parts of Himachal Pradesh, Uttar Pradesh and other tropical and subtropical parts of India[18]. Apart from its popularity as a garden plant, *Lanata camara* is said to form a useful hedge and to provide a good preparation for crops, covering the ground with fine leaf mulch. It improves the fertility of rocky, grave, or hard laterite soils, enriches the soil, and serves to retain humus in deforested areas and checks soil erosion. It can serve to nurse the parasitic sandalwood seedlings and in the Pacific islands has been used as a support for yam vines. Polishing of house floor with leaf plant extracts obtained *Lantana camara* is routinely done to drive away mosquitoes and other insect's flies as common tradition among the community members of rural tribal people [19].

Reported Phytoconstituents:

Lantana camara have therapeutic potential due to the presence of natural agents, Majority of their activity is due to bioactive compounds viz. flavones, isoflavones, flavonoids, anthocyanins, coumarins, lignans, catechins, isocatechins, alkaloids, tannin, saponins and triterpenoids. *Wollenweber et al;)* have identified and documented the presence of two triterpenoid esters viz. camarilic acid and camaricinic acid[20]. *Silva et al;* determined the chemical composition of essential oils collected from different regions. The main constituents found in the oil were limonene, α-phellandrene, germacrene-D, β-caryophyllene,

sabinene, β-caryophyllene, α-zingi- berene and α-humulene[21]. In the same course of study *Misra and Laatsch* investigate and reported oleanolic acid, oleanolic acid acetate, oleanonic acid, lantadene A, camaric acid, β-sitosterol and its glucoside, pomonic acid along with two new and several unidentified complex mixture of triterpenoids in root part of *Lanata camara*[22]. In contrast to that *Khan et al;* performed GC-MS analysis of Oil obtained from leaves and flowers of *Lanata camara* and reported that *Lantana* oils also contain β-elemene, γ-elemene, α-copaene and α-cadinene as major constituents [23]. In the same course of phytochemical screening study, *Sefidkon* again documented the presence of limonene and other chemicals in oil of *Lanata camara* leaves [24]. Moreover *Begum et al;* isolated and confirm the presence of pentacyclic triterpenoids, ursoxy acid, methyl ursoxylate, and ursangilic acid, along with dotriacontanoic acid, oleanolic acid acetate, and tetracosanoic acid using structure elucidation in arial parts of *Lanata camara*[25]. *Oyedeji et al;* obtained yellow colored oil with fruity spearmint odour from hydrodistillation of *Lanata camara* leaves with percentage yield of 0.44% (w/w). Through the GC–MS analysis, they identified a total number of 39 compounds, having sesquiterpenoids including β-caryophyllene, α-humulene, germacrene D, cubebol and bicyclogermacrene chiefly, while sabinene, α-pinene and β-pinene were the dominant hydrocarbon monoterpenes. In continuation of phytochemical screening of *Lanata camara, Khan et al;* performed GC and GC–MS examination of fruits and stem essential oils. The results revealed that fruit and stem oils were having palmitic acid, stearic acid, and germacrene-D[26]. They also concluded that the fruit oil almost matched with the stem oil in respect to its chemical constituents but differed significantly with respect to the percentage composition of its constituents. In the same course of investigations *Begum et al;* reported presence of three new pentacyclic triterpenoids camarin (=(7α)-7-hydroxy-3-oxoolean-12-en-28-oic acid; **A**), lantacin (=(3β,19 α,22 β)-3,19-dihydroxy-22-[(3-methylbut-2-enoyl)oxy]urs-12-en-28-oic acid; **B**), and camarinin (=(22β)-3β,25-epoxy-3-hydroxy-22-[(3-methylbut-2-enoyl)oxy]-11-oxoolean-12-en-28-oic acid; **C**) in aerial parts of *Lanata camara*[27]. Moreover; *Misra et al;* identified and reported again, Sabinene, 1,8-cineole, β-caryophyllene and α-humulene, sesquiterpenoids humulene epoxide III and 8-hydroxybicyelogermaerene in leaf and flower oils of *Lanata camara.* The already reported phytoconstituents in different parts of *Lanata camara* were again confirmed.[29,30,31]



Reported Pharmacological Activities:

The available research data indicates that *Lanata camara* not only have many traditional uses, but also possess enormous Pharmacological values. A compilation regarding establishment of these values is made here; *Pass et al;* fixed perfusion caudate lobe of the liver of normal sheep and of sheep poisoned by the plant *Lantana camara* L. with a mixture of glutaraldehyde and paraformaldehyde, and examined the prepared tissues using transmission electron

microscope[32]. They concluded that ingestion of *Lanata camaara* causes closure of bile canaliculi and damage to microvilli, resulting in decreased bile secretion. A marked increase in agranular endoplasmic reticulum was also observed. *Sharma et al;* found that oral administration of *Lanata camara* leaf poweder in guinea pigs causes loss in hepatic and renal tissue dry weight, DNA and protein contents[33]. In liver total carbohydrate content were also decreasing, but remail unchanged in kidney. At the same time it was found that RNA contents increase in both the organs i.e. liver and kidney but the lipid contents were found to increase in liver and get decreased in kidney. From the findings they suggest that *Lanata camara* leaf powder causes significant alteration in various biological parameters. In preceding years it was also found that toxicity due to *Lanata* causes an increase in haematocrit, erythrocyte and leukocyte number, haemoglobin, urea-nitrogen and bilirubin contents of the blood in gunea pigs. Bilirubin contents were predominantly in conjugated form. Beside these; increase in enzyme activities of SGOT, SGPT, dehydrogenase such as lactate, glutamate and sorbitol was also observed, while glutamic pyruvic transaminase showed a marginal decrease and no effect was found on alkaline phosphatase. In the same course of study it was fonud that if oral administration of lantana leaf powder in guinea pigs causes an increase in activities of lysosomal enzymes such as; acid phosphatase, cathepsin B and DNase II. Enzyme activities of glucokinase, aldolase, lactate dehydrogenase and glucose-6-phosphate dehydrogenase were elevated whereas activity of glutathione-S-transferase decreased. It was also concluded that alterations in lysosomal and cytosol enzyme activity may be responsible for pathogenesis of *Lantana* toxicity in guinea pig liver. *McSweeney and Perse* studied absorption profile of *Lantana canara* toxins by infusion in different segments of isolated alimentary canal[34]. Severity of toxicity was considered as extent of absorption. Although the absorption was maximum through small intestine, but was also significant from stomachs and large intestine. The administration of collected rumen contents from intoxicated animals causes intoxication of healthy animals, while the door group of animals showed recovery. On behalf of observations; they conclude that the large proportion of administered dose of toxin retained within rumen and the continuous absorption of the toxins is necessary to maintain the disease. Along with this decrease flow of small intestine contents were also found. Following the above investigation it was found that oral administration of *Lanata camara* and its toxic triterpene reduced lantadene A; in sheep and female rats causes bile canalicular injury, while about 85% excretion of reduced lantadene A was found on administration in portan vein of sheep in subsequent days. Bile canalicular membrane fractions prepared from intoxicated rat was found to posses reduced lantadene A metabolites. At the same time ^{13}C NNR spectra of these fractions indicate disorganisation of the membrane phospholipids. On the basis of finding it was concluded that *Lantana* toxins are excreted in bile and choleatasis may result from an interaction of triterpene metabolites with components of the bile canalicular membrane. *Pass et al;* studied metabolism of triterpene acid reduced lantadene A in intoxication susceptible and resistant rats and sheep. Sheep and susceptible female rats were found to produce a similar major metabolite [35]. Additionally; rats also produced a second metabolite i.e glucuronide. These metabolites were also observed in extracts of bile canalicular membranes prepared from intoxicated rats. Including these; resistant male and female rats also produced a similar major metabolite which was different to those synthesized by susceptible animals. From the study it was concluded that in rats and sheep there is a correlation between the type of metabolites produced in liver and the susceptibility to intoxication by reduced lantadene A. *Sharma et al;* purified isolated toxin preparation of *Lantana camara* leaves named C [36]. It was found to exist in two different crystalline form i.e form I (white, fluffy, rod-

shaped) and form II (irregular, polyhedral, shining), and was also differ in reference of melting point behaviour and heterogenic action on oral administration in guinea pigs. Only form II was found to be heterogenic to guinea pigs and was associated with decreased feed intake, faecal output, hepatomegaly and increase in plasma bilirubin level and acid phosphatase activity. In subsequent years *Lanata camara* leaves were found to posse's antilymphocytic, immunosuppressive and hypoglycemic activity [37]. More over; it was reported that the alcoholic extract of *Lanata camara* causes lowering in blood pressure and uterine motility. In the same investigation acceleration of deep respiration and stimulation in intestinal movement was also concluded with similar extract. In continuation on investigation on *Lanata camara,* oral administration of leaf powder was found to elicit cholestasis. Liver homogenate, bile, gall bladder, blood, urine, gastrointestinal tract and faece contents were analysed for the presence of reported principal hepatotoxin *viz*. lantadene A (LA), its congeners and biotransformation products, using high performance liquid chromatographic technique. Lantadenes were not found present in liver, bile, gall bladder, blood and urine samples. Lantadene A (LA), lantadene B (LB), and their respective derivatives i.e.reduced lantadene A (RLA), reduced lantadene B (RLB) along with two unidentified metabolites were found present in lower GIT and faeces contents. From the *in vitro* studies it was also found that *Lantana camara* leaf powder with guinea pig caecal contents under anaerobic conditions elicited biotransformation of LA and LB to RLA and RLB, respectively. While the incubation of similar powder with cattle rumen liquor with same condition was not found to effect on biotransformation of lantadenes [38]. At the similar course of period antibacterial, antifungal [39] and anthelmintic [40] property of essential oil obtained from *Lantana camara* was also eatablished. *Sharma et al;* investigated detoxification of lantadene A by the bacterial strain *Alcaligenes faecalis*[41]. The extract of fermentation broth in which lantadene A was incubated with *Alcaligenes faecalis* was not found to elicit any alterations in blood enzyme prolife or liver histopathology, when compared with the control group, and was concluded that *Alcaligenes faecalis* causes detoxification of lantadene A without producing any noxious agent. Mean while *Bouda et al;* investigated effect of essential oil extracts from *Ageratum conyzoides, Chromolaena odorata*, and *Lantana camara* leaves against morality of the maize grain weevil, *Sitophilus zeamais*. *Lanata camara* essential oils used in concentration range of 0.063, 0.125, 0.25 and 0.50% (v/w) was found to produce effective insecticidal property (LD50=0.16%) [42]. In the course of determination of pharmacological values of *Lanata camara Dua et al;* evaluated different isolated fractions from flower region for repellent property against Aedes mosquitoes[43]. The chloroform fraction was found to produce 100% protection for 2 h and 75.8% protection for 7 h against the Aedes mosquitoe bites. At the same time *Emmanuel et al;* demonstrated that the ethanolic extract ointment of *Lanata camara* induces healing of dermatophilosis without recurrence in experimental animals[44]. *Mello et al;* investigated effects of hydroalcoholic leaf extract of *Lantana camara* on fertility, general reproductive performance and teratology in the rat. Result date revealed that the extract interfer in the frequency of fetal skeleton anomalies, without any signs of maternal toxicity [45].

Following the above said work effects of *Lantana camara* leaf constituents (*Lantana camara* leaf powder, *Lantana camara* methanolic extract, lantadene A, neostigmine and neostigmine + *Lantana camara* methanolic extract) on intestine motility using charcoal meal test in mice have also been investigated. The results indicate that intestinal transit and fecal output decrese with increase in dose of *Lantana camara* methanolic extract. Mean while *Basu et al;* evaluated antibacterial activity of different extracts of *Lantana camara* root-bark along with two other plant, using agar-well diffusion method. Chloroform and

methanolic extract of *Lanata camara* was found to be more specific towards the gram-positive strains, although gram-negative *P. aeruginosa* was also inhibited by the methanol extracts in a dose dependent manner, while the aqueous extract was found to be inactive. On the other hand *Qamar et al;* isolated lantanilic acid, camaric acid and oleanolic acid from methanolic extract of the aerial parts of *Lantana camara* and found that these compounds exhibited 98%, 95% and 70% mortality; respectively, against root-knot nematode *Meloidogyne incognita* at 0.5% concentration[46]. *Girme et al;* investigated methanolic extract of leaf, stem and root part of *Lantana camara* for anthelmintic activity against *Pheritima posthuma*[47]. The extract was found to posses significant anthelmintic activities and was in sequence as stems > leaves >roots. Meanwhile; *Verma and Verma* expressed data on termiticidal effects of *Lanata camara* extract against adult termite workers [48]. Petroleum ether, methanol, water, methanol: water (90:10), hexane, chloroform and n-butanol extracts were used for the study. The result data indicate that 5% chloroform extract was significantly effective against termite workers. At similar time *Kumar et al;* investigated and proved antimicrobial potency of a number of medicinal pants including *Lanata camara* using agar dilution method against a number of microbes [49]. In consonance of above said work *Misra et al;* presented data on antifilarial activity of *Lanata camara* stem extract. The extract was evaluated against *Brugia malayi, Mastomys coucha* and *Acanthocheilonema viteae* and was found significantly effective against all. Subsequently; *Braga et al;* confirmed the antileishmanial and antifungal activity of *Lanata camara* methanolic extract along with other plants against *Leishmania (L. amazonensis* and *L. chagasi*) and two yeasts *(Candida albicans* and *Cryptococcus neoformans*)[50]. In addition to that *Dabur et al;* confirmed the previous work done regarding antimicrobial property of *Lanata camara*. Different extracts of *Lanata camara* was investigated against bacteria and pathogenic fungi, using microbroth dilution assay methos [51]. Among all the used extracts; aqueous extracts was found to exhibit best activity against all the tested bacteria and pathogens. Beside these *Lanata camara* aqueous extract have also been reported to posses partial antiviral activity against white spot syndrome virus[52]. Moreover; *Begum et al;* proved antimycobacterial activity of *Lanata camara* against *Mycobacterium tuberculosis* on isolated flavonoid viz. linaroside and lantanoside and their acetyl derivative[53]. These compounds exhibited 30, 37 and 98% inhibition of the bacteria, respectively. In continuation of the above work *Jonville et al;* investigated and proved antimalarial activity of dichloromethan (CH_2Cl_2) and methanol (MeOH) of *Lanata camara* for antimalarial effect through *In Vitro* as well as *In Vivo* studies against *Plasmodium falciparum* and *Plasmodium berghei* respectively [54]. Among these dichloromethane was found to posses more potent activity. In addition to the above work *Begum et al;* isolate pomolic acid, lantanolic acid, lantoic acid, camarin, lantacin, camarinin, and ursolic acid from aerial part of *Lanata camara* and investigate them for nematicidal activity against root-knot nematode *Meloidogyne incognita.* Pomolic acid, lantanolic acid, and lantoic acid was found to exhibit 100% mortality at 1 mg/ml concentration after 24 h, while camarin, lantacin, camarinin, and ursolic acid produce similar effect after 48 h at similar concentration[55]. Along with this; mosquito larvicidal activity of alcoholic extract of leaves and flowers of *Lantana camara* have also been established against larvae of mosquito species *Aedes aegypti* and *Culex quinquefasciatus*[56].. *Gidwani et al;* evaluated aqueous extract of aerial parts of *Lantana camara* for analgesic and anti–inflammatory activity against hot plate method and carrageenan induced paw oedema model in rats[57]. The result data strongly suggest for analgesic and anti–inflammatory potential of *Lanata camara*. In another study *Nayak et al;* evaluated wound healing potential of aqueous extract of *Lanata camara* leaves against excision wound model in rats. The result data emphasise on wound healing capacity

of *Lanata camara* aqueous leaf extract, as an increase in wound contraction rate, collagen synthesis and reduction in mean wound healing time was observed. In preceeding days of research *Mdee et al;* estimated acetone extract of different plants and their various parts including *Lanata camara* for antifungal activity against various phytopathogenic fungi[58]. Acetone extracts of different parts of *Lanata camara* were found to produce moderate to good antifungal activity against all fungi with minimum inhibitory concentrations (MICs) ranging from 0.08 mg/ml to 2.5 mg/ml. Subsequently; *Dash et al;* investiagated insecticidal potency of isolated essential oil from the leaves of *Lantana camara* against mosquito vectors, using WHO method for determination of adulticidal activity[59]. Study results indicate that adulticidal activity can be optimized for longer period at low storage temperature. On behalf of the results, they also concluded that *Lanata camara* essential oil can be utilized for development of oil-based insecticide as supplementary to synthetic insecticide. On the other hand *Mani et al;* confirmed the antimicrobial activity of alcoholic and aqueous extract of *Lantana camara* by measuring the zone of inhibition of different bacterial culture using disc plate method[60]. In the same course of work *Pattnaik and Pattnaik;* investigated *Lanata camara* essential oil for antibacterial activity quantitatively by determining the MIC against *Escherichia coli*, *Staphylococcus aureus, Bacillus sp* [61]. similar workers also analysed the wound healing property of the same oil in guinea pig. The results of their study revealed that the *Lanata camara* oil is highly effective against *E. coli* and *Staphylococcus aureus* as compared to antibiotics used in study, although the other bacteria were also significantly inhibited. Beside this, wound healing potential of *Lanata camara* was again proved. In another study *Bansal et al;* proved the chemoprotective effect of Lantadene A and its congener methyl ester (Methyl22β-angeoloxyloxy-3-oxoolean-12-en-28-oate;) against 7, 12-dimethylbenz *[a*] anthracene (DMBA) followed by 12-O-tetradecanoylphorbol-13-acetate (TPA) induced squamous cell carcinoma in mice, and histopathology was also performed[62]. From the results it was inferred that both the agents are potential chemopreventive in nature and may be linked to the expression of transcription factors. At similar duration, in order to establish the pharmacological basis for the ethno medicinal use of *Lantana camara* Linn. in gastrointestinal affections *Sen et al;* examined methanol leaf extract for antiulcerogenic potential against aspirin, ethanol and cold restraint stress induced gastric lesions in rats[63]. The decrese in volume of gastric juice, total acidity, free acidity and increases pH indicate the potential antiulcer effect of the extract. The ulcer healing potency was found in dose dependent manner. During the similar study it was also concluded that extract also possess *in vivo* antioxidant activity as it increases superoxide dismutase, catalase, reduces glutathione level in extract treated animals. In the same year *Vadlapudi and Naidu* again confirm the antimicrobial activity of *Lanata camara* using methanolic extracts from different parts, and found effective against medically important pathogenic strains [64]. They concluded that plants can be used to discover bioactive natural products that may serve as leads in the development of new pharmaceuticals that address not fulfilled therapeutic needs. On the other hand *Oyedapo et al;* investigated anti-inflammatory activity of various extract of *Lantana camara*, Linn and its fractions using stabilization of red blood cell membrane lysing technique[65]. The percentage membrane stability exhibited by the extract and various fractions was found concentration dependent, although ethyl acetate fraction provided highest protection against induced lyses and exhibited both monophasic and biphasic responses at all the concentrations assayed. In another study *Lanata camara* essential oil was reported to posses significant larvicidal potency against *Aedes aegypti* larvae.

In continuation of the determination of pharmacological values of *Lanata camara Sathish et al;* investigeted methanolic extract of leaf part for

ulcer protective effect against aspirin induced gastric ulcer, ethanol induced gastric ulcer, pyloric ligation induced ulceration and cysteamine induced duodenal ulcer in animal models [66]. Along with ulcer index, total acidity and gastric environment pH, lipid peroxidation, reduced glutathione levels in ethanol induced ulceration and inhibition zone in diameter against *H. pylori* were also determined. The result data indicated both ulcer healing as well as ulcer protective potential of *Lanata camara* methanolic leaf ectract. In addition to that *Vardhana;* documented antibacterla potential of ethanolic and aqueous extract from *Lantana camara* (L. camara) against Gram-positive as well as Gram-negative bacteria [67]. The similar activity of *Lanata camara* was again confirmed by using methanol extract [68], and on other parts of the plant [69, 70]. In consonance of the research on *Lanata camara* reported the anthelmintic and antimicrobial activiry of *Lanata camara* using different extracts[71]. At the similar duration of time anthelmintic activity of *Lanata camara* was again investigated and documented using successive extracts [72]. On the other hand larvicidal potential of essential oils extracted from *Lanata camara* leaf has also been investigated and reported against the *Culex pipiens.* Although the toxicity of *Lanata camara* is well known yet; its acute poisoning effect has also been investigated in mice using its apolar and polar extracts. Result data showed that although both the extracts produces similar percentage of death, mainly after 2 days of treatment; only the apolar extract presented a dose-dependent increased lethality, and that could be due to the presence of triterpenoids in apolar extract. The toxic profile of *Lanata camara* have also been determined using methanol extract of its different parts agaist *Artemia salina* and was found that the root extract was most toxic and have potential as anticancer agent[73]. The antifungal potential of *Lanata camara* have also been investigated. The related document suggest that the treatment of *Alternaria sps.* with *Lanata* leaf powder causes its significant inhibition. The result data indicate that antifungal components from *Lanata camara* can be used as an alternative to develop noval fungicides by replacing some chemical commercial antifungal for the disease cause by *Alternaria sps*.[74,75]. Beside these the traditional use of *Lanata camara* root have also been scientifically proved in treatment of urolithiasis using ethanol extract [76]. The another research also confirmed the hemolytic activity of *Lanata camara*, which was assessed using different solvent extracts and the activity was found in order of; chloroform fraction > hexane and ethyl acetate fraction (50:50) > aqueous extract > ethanol fraction > methanol fraction[78]. In subsequent year antibacterial property of *Lanata caamara* was investigated and established again, using aqueous and alcoholic extracts against *Proteus mirabilis* by serial dilution method [78]. In continuation of the findings on pharmacological values of *Lanata camara Mushatq et al;* also presented data on antimicrobial and antifungal property, and suggest that the plant part extract may be used as alternative to commercial antifungal and antibacterial agent [79]. Moreover; the antimicrobial potency was again confirmed using extracts of different polarity, and the folk use of the plant as bactericidal was justified [80]. In consonance of the research on *Lanata camara,* the ethanolic extract of root part as well as oleanolic acid isolated from root have also been investigated for antiurolithiatic activity against ethylene glycol induced urolithiatic model in rats. The findings strongly justified the therapeutic utility *Lanata camara* for the treatment of renal injury [81]. Beside the all above said pharmacological values of *Lanata camara, Jain and Joshi*; have also been again confirmed the previous reported work regarding wound healing capacity of the plant [82].

CONCLUSION

It is quite evident from this review that *Lanata camara* contains a number of phytoconstituents which reveals its uses for various therapeutic purposes. The Plant or its individual parts can be used for the treatment of various disorders in human being such

as, antiulcer, analgesic, antiinflammatory, antimicrobial, anthelminthic, anticancer antifungal, antibacterial antiurolithiatic and wound healing. Still, so much work is required with the *Lanata camara* to investigate the mechanism of actions with other therapeutic activities.

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