Pharmacognosy Reviews, 2024; 18(36):101-110.
www.phcogrev.com

Review Article

Current Status and Challenges of Two Overlooked Medicinal Plants *Cestrum diurnum* and *Cestrum nocturnum*: A Review

Shafquat Fakhrah[1,2], Chandra Sekhar Mohanty[2], Alka Kumari[1,*]

[1]Department of Botany, University of Lucknow, Hasanganj, Lucknow, Uttar Pradesh, INDIA.
[2]Department of Plant Genetic Resources and Improvement, Division of Plant Genetic Resources and Improvement, CSIR-National Botanical Research Institute, Lucknow, Uttar Pradesh, INDIA.

ABSTRACT

Previously, most pharmaceutical compounds were produced from naturally occurring components in plants. However, many plant species with high therapeutic potential have been overlooked or neglected. In an era of unfavorable climatic and human changes that endanger natural vegetation worldwide, it is critical to find and research these neglected medicinal plants. The genus *Cestrum* belonging to the family Solanaceae, which includes *Cestrum diurnum* and *Cestrum nocturnum*, contains a wide variety of important nutritional, chemical and medicinal properties. Both plants have become popular garden plants, but they also possess therapeutic potential. *C. diurnum* has been shown to possess antioxidant, hepatoprotective, larvicidal and cardioactive properties, also has potential to make a supplement of vitamin D3, while *C. nocturnum* has anti-inflammatory, analgesic, antimicrobial and anticancer effects. The distribution, physical traits, ecological preferences and ethnobotanical uses of both plant species are explored in the present review, which demonstrates that *C. nocturnum* shows significant potential due to its high phytochemical content and extensive ethnobotanical applications. In contrast, *C. diurnum*, though equally promising, has been less explored. Here, we demonstrate that these neglected medicinal plants can be the next breakthrough in drug development. We also emphasize the significance of sustainable methods that assure the use and preservation of these rich resources.

Keywords: *Cestrum diurnum*, *Cestrum nocturnum*, Distribution, Diversity, Ethnobotany, Medicinal plant, Phytochemical.

Correspondence:
Dr. Alka Kumari
Professor, Department of Botany, University of Lucknow, Babuganj, Hasanganj, Lucknow-226025, Uttar Pradesh, INDIA.
Email: kumarialkasanjay@gmail.com
ORCID: 0000-0003-3972-9467

Received: 17-09-2024;
Revised: 04-10-2024;
Accepted: 30-10-2024.

INTRODUCTION

The genus *Cestrum* of the Solanaceae family has two plant species: *C. nocturnum* and *C. diurnum* (Figure 1).[1] *C. nocturnum* is commonly known as rat ki rani, night-cestrum, lady of the night, queen of the night, or night-blooming jasmine,[2] while *C. diurnum* is also known as day jasmine or din ka raja.[3] Both are unique plant species with diverse botany, photochemistry and molecular traits and their botanical traits and chemical contents are comparable;[4] their different flowering patterns provide a distinct perspective on their adaptive strategy. Several plant species are being studied for their phytochemical and biological screening and have been implicated in their action against a wide range of diseases.[5,6] The Solanaceae family, also known as the nightshade or potato family, holds great significance for humanity due to its diverse range of nutritional, chemical and therapeutic uses.[7] These plants grow in warm and moderate regions worldwide, especially in the Southern Hemisphere.[8] Central and South America are recognized as major dispersal centers and are believed to be the origins of Solanaceae.[9] They provide numerous benefits to humans and are therefore widely studied and valued. *C. nocturnum* and *C. diurnum* provide excellent comparative research topics since they have distinctive molecular properties, chemical compositions and botanical characteristics. These plants have been the subject of in-depth study and admiration due to the variety of advantages they provide. *C. nocturnum* is also known for its fragrant flowers that bloom at night,[10] while flowers of *C. diurnum* are not fragrant and bloom during the day.[1] Additionally, *C. nocturnum* has been used in traditional medicine for its medicinal properties, while *C. diurnum* has not been extensively studied for its potential medicinal benefits. Comparative studies of these plant species within the same genus provide various advantages, including improving our understanding of species diversity, evolutionary processes and ecological relationships. This review highlights the similarity in medicinal potential of *C. nocturnum* and *C.*

DOI: 10.5530/phrev.20241937

Publishing Partner : Manuscript Technomedia. [www.mstechnomedia.com]

diurnum, which are primarily ornamental plants. Despite their current under appreciation in the medicinal field, these plants hold significant promise for developing novel drugs and valuable therapeutics using modern drug discovery methods. Additionally, this study can provide insights into species diversity, evolution and ecological relationships, thereby revealing new avenues for their potential applications.

MATERIALS AND METHODS

The present study investigates the medicinal properties and challenges of *C. diurnum* and *C. nocturnum* through a combination of literature review, field surveys and laboratory analyses. The plant species were selected based on their reported medicinal value and presence in ethnobotanical records and samples were collected from diverse ecological studies. Specimens were identified using botanical keys and authenticated by taxonomic literature.

Data collection involved a systematic review of available literature on *C. diurnum* and *C. nocturnum*, using databases like PubMed, Scopus and Google Scholar to extract information on their phytochemical composition, medicinal uses and challenges related to their cultivation, conservation and utilization. The data collected was synthesized using qualitative and quantitative approaches, summarizing key findings and trends in the use of *Cestrum* species in medicinal practices. Potential limitations of the study include limited access to some geographic regions and variability in traditional medicinal practices across different regions.

RESULTS

Distribution

C. nocturnum and *C. diurnum* have distinct but overlapping global populations (Figure 2). *C. nocturnum*, originating from the West Indies and Central America, can be found in countries such as Mexico, Cuba and Jamaica. It is commonly planted as an ornamental shrub throughout tropical and subtropical regions worldwide, including Mexico, Australia, New Zealand and various Central American and Caribbean countries, making it a highly valued garden species.[11] It is commonly planted as an ornamental plant throughout many tropical and subtropical regions of the world and is highly valued as a garden shrub species.[12] As a result, it can be found in botanical collections, gardens and parks around the world. As a result, *C. nocturnum* is present in botanical collections, gardens and parks globally.[13] Likewise, *C. diurnum*, native to Puerto Rico, Jamaica and Cuba, has been introduced as an ornamental plant to various tropical and subtropical areas worldwide, including India, South Africa and the Pacific Islands.[14] This species thrives in disturbed lands, pastures, roadsides and secondary forests but not in swampy or exposed subsoil and it is frequently cultivated for its ornamental qualities in places where it has been introduced.

As garden plants, both *C. nocturnum* and *C. diurnum* have attracted increasing interest. While *C. nocturnum* is known to grow in areas outside of its natural environment, *C. diurnum* is found largely in its native regions or in areas where it has been brought for decorative purposes. Both species are closely related, with some physical similarities but also major differences.

Morphological characteristics and ecological preferences

While *C. diurnum* can reach a height of 2 m, *C. nocturnum* usually reaches a maximum height of four meters (13 feet).[15] *C. nocturnum* has glossy, smooth-edged, lance-shaped leaves, while *C. diurnum* has alternating, simple, short leaves with a maximum petiole length of 1.2 cm. *C. nocturnum* blooms at night with strong, fragrant flowers that are tubular and greenish-creamy white or light greenish-yellow in color.[16] *C. diurnum* yields creamy white, trumpet-shaped blooms gathered in the axils of the upper leaves. They smell nice during the day (Figure 1a). After flowering, *C. nocturnum* produces tiny white berries approximately 8-10 mm long. These berries are dispersed by birds.[17] Additionally, the fruits of *C. diurnum* are nearly spherical and black. *C. nocturnum* is a plant that grows in various soil types, especially rich, loamy soil or dry, sandy soil. It is barely resistant to salinity and flooding.[18] In contrast, *C. diurnum* thrives in regions with high rainfall and can withstand salt stress.

Ethnobotanical uses and pharmacological properties

Different cultural patterns in the traditional applications of *C. diurnum* and *C. nocturnum* have big influence on their pharmacological studies. *C diurnum* and *C nocturnum* have been used in various cultures for their medicinal properties.[19] They are traditionally used to treat inflammation, pain and wounds. In addition to their medicinal uses, these plants are also used in ceremonies and as natural remedies for common health issues. The leaves, flowers and roots of these plants are prepared in different forms such as teas, poultices and extracts to harness their therapeutic effects. Both species have significant pharmacological activities, including anti-inflammatory, analgesic and antimicrobial effects. These two species share several common characteristics, as summarized in Figure 2, which provides an overview of their traditional uses and pharmacological activities.

The analgesic, antioxidant, antipyretic, antimalarial, anti-inflammatory, anti-hyperlipidemic, antimicrobial, anticonvulsant, insecticidal, antifungal, anti-HIV, anti-hepatotoxic, anticancer and antidiabetic properties of *C. nocturnum* are widely recognized (Table 1). *C. diurnum* has several medicinal properties, including analgesic, antioxidant, antipyretic, antimalarial, anti-inflammatory, anti-hyperlipidemic, antimicrobial, insecticidal, antifungal, anticancer, antidiabetic and antipsoriatic actions (Table 1). The anticonvulsant, anti-HIV and anti-hepatotoxic qualities of *C. nocturnum* are unique,

whereas the antipsoriatic effects of *C. diurnum* are the only known benefit.

Pharmacological studies on these plants' special qualities might be centered on their ethnobotanical usage. *C. diurnum* may have antipsoriatic properties; *C. nocturnum* deserves more research due to its potential in treating convulsions, HIV and liver damage.

Chemical analysis and alkaloid composition

C. diurnum has several bioactive compounds with various proposed mechanisms of action that provide significant health benefits. As it contains alkaloids like nicotine and nornicotine which have structural similarities to tobacco compounds, there is a theory that they act on nicotinic cholinergic receptors in the brain to improve alertness and cognitive function.[20] Diurnoside and Cesdiurins I, compounds found are only in *C. diurnum*, they have been shown to have antimicrobial, analgesic and anti-inflammatory properties in preclinical models.[21] Ursolic acid, a triterpenoid compound well-known for its anti-inflammatory, anti-tumor and hepatoprotective properties, may potentially promote muscle growth, reduce obesity and improve skin health.[22] Cestrumoside III (antioxidant lignan glycoside), has potential antioxidant and estrogenic properties that may help reduce the risk of chronic diseases such as cancer and cardiovascular disease. *C. diurnum* has also been reported to contain the active form of 1, 25-dihydroxy vitamin D3, a vital compound for maintaining bone health and regulating calcium homeostasis.[23] This active form of vitamin D3 plays a critical role in the absorption of calcium and phosphorus from the gut, which are essential minerals for the formation and maintenance of healthy bones and teeth.[24] The discovery of this bioactive component in *C. diurnum* highlights the plant's potential as a useful natural resource for the formulation of supplements and medications used to prevent and treat illnesses associated with bone abnormalities and calcium insufficiency.

Table 1: Comparative chart for the ethnobotanical uses of *Cestrum nocturnum* and *Cestrum diurnum*.

Ehanobotanical uses	*Cestrum nocturnum*	*Cestrum diurnum*
Analgesic	[45]	[46]
Antioxidant	[17]	[27]
Antipyretic	[47]	[48]
Antimalarial	[49]	[50]
Anti-inflammatory	[51]	[46]
Anti-hyperlipidemic	[10]	[52]
Anti-microbial	[53]	[54]
Anti-convulsant	[55]	-
Insecticidal	[56]	[57]
Antifungal	[58]	[59]
Anti-HIV	[60]	-
Anti-hepatotoxicity	[32]	-
Anticancer	[61]	[62]
Antidiabetic	[31]	[54]
Antipsoriatic	-	[63]

* The (-) symbol denotes the lack of that activity in the plant.

The plant *C. nocturnum* is abundant in a variety of phytochemicals such as tannins, alkaloids, fatty acids, carbohydrates, steroidal saponins, flavonoids and essential volatile oils. These compounds have several therapeutic benefits, such as antimicrobial, antioxidant, analgesic and anti-inflammatory qualities. While carbohydrates are vital for maintaining the integrity of cell membranes and cardiovascular health, alkaloids are necessary for energy and immune response. Antioxidant qualities of flavonoids are well-known for shielding cells from oxidative stress and possibly lowering the risk of chronic illnesses like cancer and cardiovascular disease. Tannins have strong astringent properties and are useful for wound healing and anti-inflammatory responses. Hepatoprotective, anti-inflammatory and anti-tumor properties are exhibited by ursolic acids. Phenolic compounds guard against diseases and damage linked to oxidative stress. Terpenes and trisesquiterpenoids exhibit anti-inflammatory, analgesic and antimicrobial properties. Apart from that, cumaric acid, vanillin, L-Arabinitol, α-amyrin, 3-tetradecynoic acid, D-mannitol, metahydroxyeugenol, eicosane, phenyl ethyl alcohol, nonadecene, dicetylglycerol, heneicosane, N-tetracosane, ethyl citrate, phytol, 4-isobutylmorpholine, N-hydroxydecanoic acid (Palmitic Acid) and α-amyrin are some of the specific compounds found in *C. nocturnum*. Together, these phytochemicals give its medicinal value and a host of health advantages.[25,26] The different

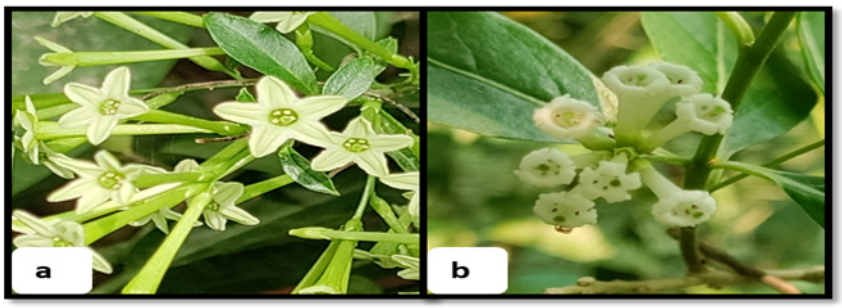

Figure 1: Flowers of (a) *C. nocturnum* and (b) *C. diurnum.*

Table 2: Comparative phytochemical composition of *Cestrum nocturnum* and *Cestrum diurnum*.

Phytochemicals	*Cestrum nocturnum*	References
Alkaloids	Nicotine	[64]
	Nornicotine	
	Cotinine	
	Myosmine	
Glycosides	Pregnane glycosides	[65]
	Cholestane glycosides	
	Pregnane-carboxylic acid	
	Γ-lactone glycoside	
Saponins	Nocturnoside A	[25,65]
	Spirostanol saponins	
	Furostanol saponins	
Flavonoids	Luteolin	[66-68]
	Kaempferol	
	Quercetin	
	Apigenin	
	Isovetixin	
	Hispertin	
	Narinjirnin	
	Rutin	
Terpenes	trans-Z-α-bisabolene epoxide, diosgenin, α-amyrin, phytol,	[69]
Organic compounds	Coumaric acid	[25,70]
	Phenyl Ethyl Alcohol	
	Ethyl citrate	
Phenolics	Gallic acid	
	Vanillin,	
	Methoxyeugenol,	
	L-arabinitol	
	Isoeugenol	
	Propyl gallate	
Long chain fatty acid	3-tetradecynoic acid	
	Diacetylglycerol	
	n-hexadecanoic acid,	
Sugar alcohol	D-mannitol	
Alkane	Eicosane	
	Nonadecene	
	n-tetracosane	
	Heneicosane	
Narcotics	phytol,	
	4-isobutylmorpholine	
Cestrum diurnum		
Phytochemicals	*Cestrum nocturnum*	References
Alkaloids	Cesdiurins I	[64]
	Nicotine	
	Diurnoside	
	Nornicotine	
Glycosides	Cestrumoside III	[22,71]
	Anor-lignan glycoside	
	Ursolic Acid	
	Tigonin	
	Liriodendrin	
	Citroside B	
Saponins	Cesdiurins I-III	[27,72,73]
	Saponin diurnoside	
	Spirostane-type saponins	
	Tigogenin	
	Tigonin	
Terpenes	Ursolic acid	[27]
Volatile oils	trans-2-Hexenal	[27]
	cis-3-hexenyl acetate	
	cis-3-hexenol	
	trans-2-hexenol	
	Palmitic acid	
	Stearic acid	
	Oleic acid	

phytochemical compositions in these two plants are listed in Table 2.

Therapeutic potential

C. diurnum

The leaves of this plant provide therapeutic benefits, including antioxidant, hepatoprotective, larvicidal and cardioactive effects.[27] In several African nations, it has been utilized in a variety of medical therapies, including skin patches, itching relief, topical psoriasis therapy and the treatment of malaria.[28] The consumption of *C. diurnum*, however, can be harmful to both human and animal health because it contains poisonous alkaloids.[16] It has a wide range of therapeutic potential, including anti-inflammatory,[29] analgesic, antimicrobial, anticancer,[30] CNS depressant, insecticidal, mosquito repellent,[31] anticonvulsant, antiepileptic, local anesthetic, antihyperglycemic, antihyperlipidemic, pesticidal, wound healing, antiarrhythmic and antitumor effects. It has also been used externally for skin disorders and possesses hepatoprotective and nephrocurative activities.[32] The essential oil and organic extracts from *C. nocturnum* flowers exhibit antioxidant activity, making them suitable for potential use in food and allied industries (Figure 2).

Ethnobotanical uses

Cestrum diurnum

This plant has a long history of use in traditional healing practices to address a variety of conditions. Its leaves or extracts are used topically to soothe red, flaky patches associated with psoriasis. Preparations made from its roots, flowers, or seeds are used to treat other skin conditions and alleviate itching.[33]

Cestrum nocturnum

Herbs and compounds derived from this plant have been used by indigenous medical practitioners to heal burns, reduce swelling, normalize low blood pressure, treat digestive issues and night sweats and for other ethnobotanical applications. Extracts from its blooms are also used in perfumes and fragrances. Recent studies have shown that this plant has properties that can protect and benefit the liver and kidneys, as well as exhibiting antibacterial effects in laboratory tests.[34]

DISCUSSION

Current scenario

The present difficulty in confirming the therapeutic qualities of *Cestrum diurnum* and *Cestrum nocturnum* are mostly caused by the following factors:

Lack of standardized formulations

Crude extracts, which might not have optimal quantities of active chemicals, are frequently used in preliminary studies on both plants. Standardized, concentrated formulations of the bioactive components must be developed to guarantee consistent outcomes in medicinal applications.

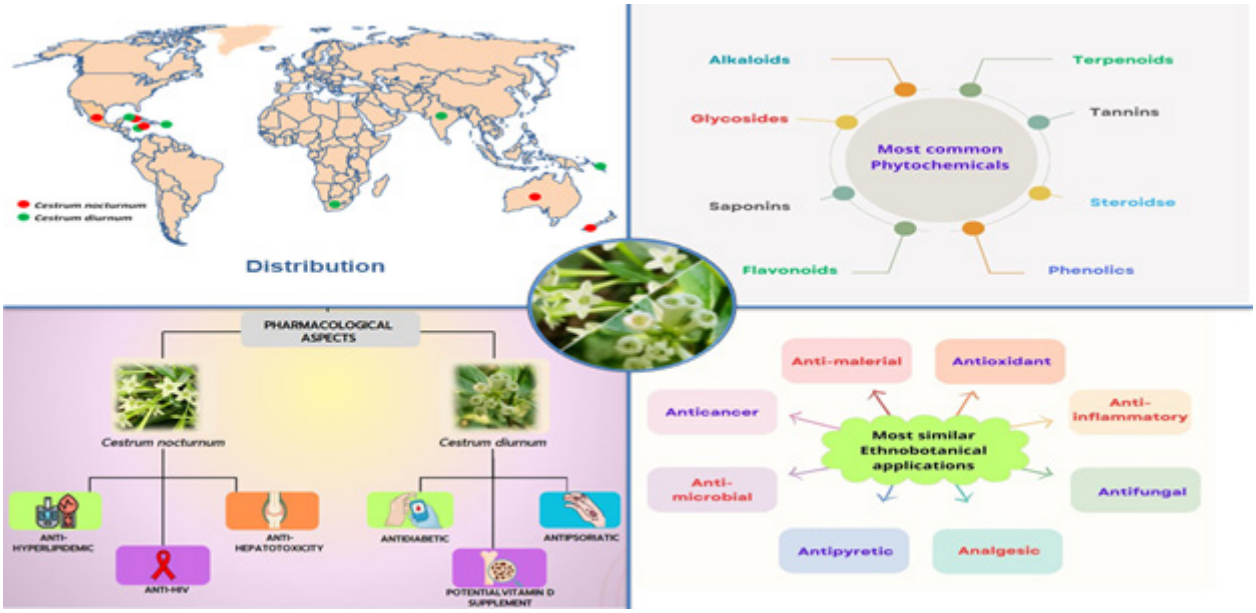

Figure 2: Graphical representation of the geographic distribution of *Cestrum nocturnum* and *Cestrum diurnum*, along with their respective countries of origin (references: Space and Flynn 2000, Al-Reza, Rahman *et al*. 2010, Punjabi, Khilnani *et al*. 2015, Nishtha, Richa *et al*. 2017). Comparison of the most common phytochemicals found in *Cestrum nocturnum* and *Cestrum diurnum*, as well as an illustration of their similar ethnobotanical uses and differing pharmacological aspects.

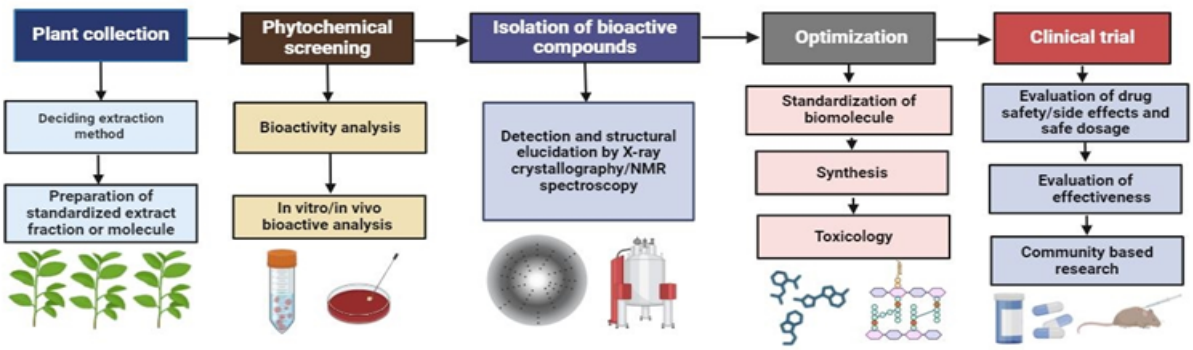

Figure 3: The step-by-step process of developing a bioactive compound from medicinal plants.

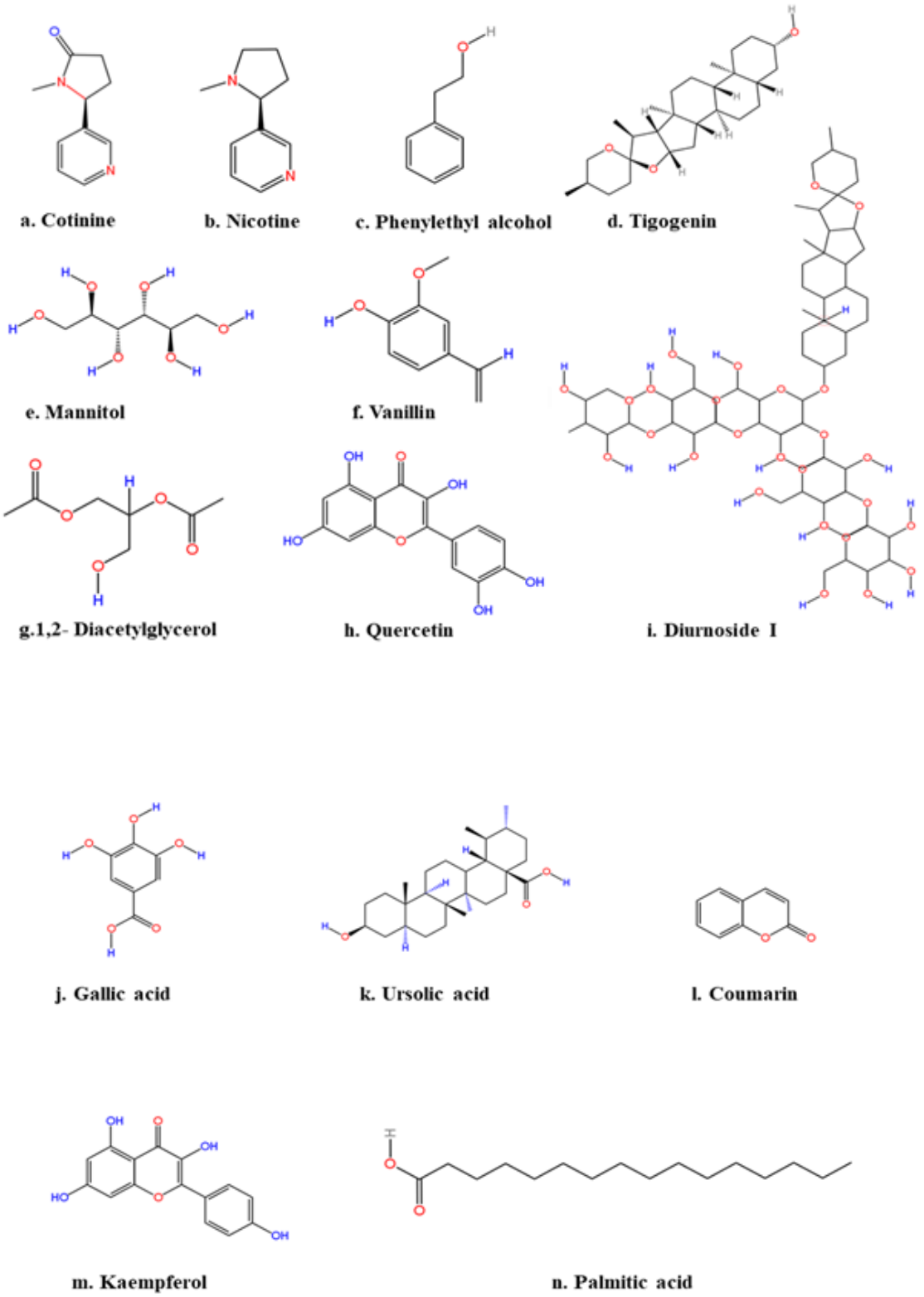

Figure 4: Chemical structures of selected compounds identified in *Cestrum nocturnum* and *Cestrum diurnum* based on literature reviews. Compounds include (a) cotinine, (b) nicotine, (c) phenylethyl alcohol, (d) tigogenin, (e) mannitol, (f) vanillin, (g) 1,2-diacetylglycerol, (h) quercetin, (i) diurnoside I, (j) gallic acid, (k) ursolic acid, (l) coumarin, (m) kaempferol and (n) palmitic acid.

Insufficient clinical and preclinical research

The majority of investigations on these plants have been restricted to basic *in vitro* or small-scale *in vivo* tests. Although they offer preliminary proof of effectiveness, larger preclinical studies and thorough clinical trials are necessary to validate their safety and therapeutic potential.

Complexity of phytochemical composition

A wide range of phytochemicals, including as polyphenols, terpenoids and alkaloids, are present in both plants. It is difficult to completely comprehend their modes of action and to isolate and identify the essential molecules owing to their therapeutic characteristics due to the variety in their chemical makeup.

Limited bioavailability and possible adverse effects

When utilized in medicinal settings, several of the chemicals found in these plants may have limited bioavailability or have unclear adverse consequences. Improving these substances' bioavailability and reducing side effects are essential obstacles to their therapeutic use.

Absence of sustainable harvesting methods

It is critical to provide a dependable and sustainable source of plant material for scientific study and medicinal applications. Their availability might be threatened by overharvesting or environmental changes, which would be a serious obstacle for ongoing research.

To advance the identification and validation of *C. nocturnum* and *C. diurnum* for medicinal applications, a more focused and intensive approach with expanded resources is essential. Although preliminary small-scale research employing crude extracts from plant oils or leaves has provided encouraging results,[35-37] substantial effort is required to develop optimized formulations with the desired active ingredients. Basic laboratory mouse and cellular test systems have produced some encouraging results,[38,39] but specialized, concentrated products and standardized formulations are conspicuously lacking. To develop validated, consistent and customized therapeutic products that take advantage of these plants' inherent healing properties, a concerted scientific effort is needed.

Challenges

Variability in phytochemical composition

Growing circumstances, location and harvesting period are some of the variables that might affect the concentration of beneficial chemicals. Because of this, it is challenging to standardize the quantity of active substances used in formulations.

Complexity of plant extracts

Extracts from these plants may include a diverse spectrum of chemicals, some of which may interact unknowingly. Identifying the active components and their appropriate ratios can be challenging for maintaining therapeutic effectiveness.

Stability of active compounds

When exposed to light, heat, or oxygen, some compounds may deteriorate or lose their effectiveness. One major issue is making sure the formulations are stable over the long term and have a lengthy shelf life.

Toxicity and adverse effects

Since certain substances found in plants can be hazardous in larger quantities, there may be concern about the safety of using the extracts over an extended period or at high dosages. Comprehensive toxicological investigations are necessary to determine the safe therapeutic range.

Regulatory hurdles

Adequate testing to demonstrate efficacy, safety and quality is necessary to meet the regulatory standards for approval as therapeutic medicines. To meet these requirements, the extraction and formulation procedures must be standardized and validated.

Methods of sustainable preservation

Based on best practices for medicinal plant species, numerous essential strategies may be suggested to strike a balance between the long-term sustainable usage of *C. nocturnum* and *C. diurnum* and their possible commercialization for medical purposes:

Sustainable methods of harvesting

Adopt regulated harvesting procedures to prevent overuse of wild populations. Depletion can be avoided by following rules for alternating harvest cycles, selective harvesting and guaranteeing sufficient plant regeneration. Agroforestry systems or nurseries are examples of controlled habitats where these plants may be grown and they can lessen the pressure on wild populations.

Conservation *in situ* and *ex situ*

Preserving genetic variety through both *in situ* (on-site conservation in natural environments) and *ex situ* (conservation in botanical gardens, seed banks) strategies can help species survive while also helping commercialization initiatives. Additionally, it can act as a buffer in case of over-harvesting or environmental changes.

Certification and regulation

It's critical to create legal frameworks for the commercial usage of these plants. Programs for certification such as fair trade and sustainable sourcing labels can guarantee that the process of

commercialization promotes local economies while avoiding harm to the environment.

Community involvement

A symbiotic link between sustainability and commercialization may be established by including local communities in conservation efforts while also providing them with financial benefits from the plants. Encouraging responsibility for the environment and financial incentives may be achieved by offering training on sustainable practices and fair profit-sharing schemes.

Research and development

It's critical to carry out further studies on the therapeutic qualities, growing needs and ecological effects of both plants. Developing farming methods that optimize output while posing no threat to the environment is one aspect of sustainability. Scientific studies can also explore the potential for synthetic production of the active compounds, reducing the pressure on natural populations.

Drug development process

To enhance the current research, additional laboratory studies on *C. diurnum* and *C. nocturnum* to further explore their phytochemical profiles, mechanisms of action and therapeutic potentials. This includes utilizing advanced techniques such as High-Performance Liquid Chromatography (HPLC), Gas Chromatography-Mass Spectrometry (GC-MS) and Nuclear Magnetic Resonance (NMR) spectroscopy for comprehensive phytochemical screening, exploring specific bioactivities of identified compounds through *in vitro* and *in vivo* studies, investigating the molecular mechanisms underlying the therapeutic effects of these plants, conducting comparative studies to identify the most potent sources of bioactive compounds, assessing the safety and toxicity profiles of these plants in preclinical models and designing and conducting clinical trials if preclinical results are promising.[40] Furthermore, it's important to focus on the development of standardized extracts and formulations, optimize the extraction process, identify suitable delivery methods for therapeutic use and investigate sustainable harvesting practices and conservation strategies to ensure the long-term availability of these plants for research and medicinal use.[41] *C. nocturnum* and *C. diurnum* have great potential and are abundant in metabolites and antioxidants, which can be helpful in formulating several drugs. Once the chemical structure is determined, chemists may modify or synthesize the compound to improve its drug-like properties. The compounds then undergo preclinical and clinical studies to evaluate their safety, efficacy and pharmacokinetics.[42] If successful, they can advance to clinical trials involving human subjects. After successful clinical trials and FDA (The United States Food and Drug Administration) approval, the drug was launched for medical use.[43] The sequential process for possible drug development from plants is depicted in Figure 3. Additionally, Figure 4 highlights some of the key compounds found in *C. nocturnum* and *C. diurnum*.

FUTURE PROSPECTS

Biotechnology has advanced to the point where plants can produce therapeutic proteins for medications, offering effective treatments for serious diseases like cancer, diabetes, HIV, cystic fibrosis, heart disease and Alzheimer's disease. *C. nocturnum* and *C. diurnum* are promising candidates for medicinal research due to their potential therapeutic properties. These plant-based herbal medicines are considered safer and more cost-effective compared to traditional pharmaceuticals and present a lower risk of pathogen transmission. During the COVID-19 pandemic, plant-based herbal medicines gained attention as more affordable alternatives for producing treatments.[44] However, comprehensive knowledge of their physicochemical characteristics and preformulation data is essential for the effective utilization of these plants. This study explores the medicinal potential of *C. nocturnum* and *C. diurnum*, underscoring their significance as valuable natural resources. By leveraging advanced biotechnological methods, these plants can be harnessed to produce novel, safer, more cost-effective treatments with fewer risks associated with pathogen transmission

CONCLUSION

C. diurnum and *C. nocturnum*, two plants with significant medicinal potential, have been overlooked due to unsustainable exploration. These plants have unique chemical compositions, therapeutic benefits and pharmacological properties, with *C. nocturnum* being particularly noteworthy for its high phytochemical content. Sustainable preservation methods are crucial for their responsible use and maintenance for future generations. Further research and drug development strategies are recommended for improved healthcare. Ethnobotanical knowledge offers a focused, economical and culturally rich approach to medication discovery, but also presents standardization, scientific validation and sustainability issues. Balancing these advantages and drawbacks is crucial.

ACKNOWLEDGEMENT

Ms. Shafquat Fakhrah would like to express her gratitude to the Director CSIR-National Botanical Research Institute for providing working opportunities and to BioRender.com for creating images.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.**Figure 1:** Flowers of (a) *C. nocturnum* and (b) *C. diurnum*.

AUTHORS' CONTRIBUTIONS

SF wrote and formatted the original manuscript. AK provided overall guidance for the entire study and conceptualized the review, while CSM drafted and edited the manuscript.

FUNDING

The Indian Council of Medical Research (ICMR) provided a Senior Research Fellowship to Ms. Shafquat Fakhrah.

REFERENCES

1. Abouelnour AN, Elsayed AS, El-Demerdash MM. Morphological, phytochemical and therapeutic potentials investigation of some species of *Cestrum* L. (Solanaceae family). Bulletin of Faculty of Science. Zagazig University. 2022.
2. Maharjan R, Srivastava PK, Dogra A, Mainali MK, Mysore PN. Medicinal Uses of Raat ki Rani (*Cestrum nocturnum* L.): an Anukta Dravya. Indian J Anc Med Yoga. 2019;12(1).
3. Jindal S. Flowering shrubs in India. Publications Division Ministry of Information & Broadcasting; 2017.
4. Fakhrah S, Bano N, Behera SK, Rawat KK, Kumari A, Mohanty CS. Decoding the flower-anthesis mechanism in *Cestrum nocturnum* and *Cestrum diurnum*. J Plant Growth Regul. 2024;43(10):3862-77. doi: 10.1007/s00344-024-11369-w.
5. Fabricant DS, Farnsworth NR. The value of plants used in traditional medicine for drug discovery. Environ Health Perspect. 2001; 109; Suppl 1: 69-75. doi: 10.1289/ehp.01109s169, PMID 11250806.
6. Phillipson JD. Phytochemistry and medicinal plants. Phytochemistry. 2001;56(3):237-43. doi: 10.1016/s0031-9422(00)00456-8, PMID 11243450.
7. Motti R. The Solanaceae family: botanical features and diversity. In: The wild solanums genomes; 2021. p. 1-9. doi: 10.1007/978-3-030-30343-3_1.
8. Airy Shaw H, Willis J. A dictionary of the flowering plants and ferns. Cambridge: Cambridge University Press; 1973.
9. Giorgetti M, Negri G. Plants from Solanaceae family with possible anxiolytic effect reported on 19th century's Brazilian medical journal. Rev Bras Farmacognosia. 2011;21(4):772-80. doi: 10.1590/S0102-695X2011005000106.
10. Shaista A, Amrita P. Delicate, fragrant, lady of the night-a medicinal gift. J Med Plants Stud. 2016;4(6):13-7.
11. Punjabi YS, Khilnani VL, Damle PN. The investigation of antibacterial activity of *Cestrum nocturnum*. Pharmacophore. 2015; 6;2-2015: 81-7.
12. Shah VV, Shah ND, Patrekar PV. Medicinal plants from Solanaceae family. Res J Pharm Technol. 2013;6(2):143-51.
13. IUCN S. The IUCN red list of threatened species. International Union for Conservation of Nature; 2017; 2011.
14. Space JC, Flynn T. Observations on invasive plant species in American Samoa: USDA Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry; 2000.
15. Sachs RM. Floral initiation in *Cestrum nocturnum* the night blooming jasmine. California Institute of Technology; 1955.
16. Nellis DW. Poisonous plants and animals of Florida and the Caribbean. Pineapple Press Inc; 1997.
17. Al-Reza SM, Rahman A, Cho YS, Kang SC. Chemical composition and antioxidant activity of essential oil and organic extracts of *Cestrum nocturnum* L. J Essent Oil Bear Plants. 2010;13(5):615-24. doi: 10.1080/0972060X.2010.10643871.
18. Sarkar MK, Jahan MA, Roy CK, Hossain K, Rahman SS, Mia MR, et al. *In vitro* shoot micro propagation of medicinal applications and ornamental value of *Cestrum nocturnum*. Indian J Sci Technol. 2016.
19. Begum AS, Goyal M, Mag P. Review Article Research and Medicinal Potential of the genus Cestrum (Solanaceae)—a review. Pharmacogn Rev. 2007;1(2).
20. Graef S, Schönknecht P, Sabri O, Hegerl U. Cholinergic receptor subtypes and their role in cognition, emotion and vigilance control: an overview of preclinical and clinical findings. Psychopharmacology. 2011;215(2):205-29. doi: 10.1007/s00213-010-2153-8, PMID 21212938.
21. Alrabayah IN, El Hawary SS, El-Kadder EM, Essa A, Elraey M. Genus Cestrum therapeutic potential: an updated review of its phytochemical, pharmacological and morphological features. Egypt J Chem. 2024;67(1):375-93.
22. Burt S. Essential oils: their antibacterial properties and potential applications in foods-a review. Int J Food Microbiol. 2004;94(3):223-53. doi: 10.1016/j.ijfoodmicro.2004.03.022, PMID 15246235.
23. Chennaiah S, Qadri SS, Rao SV, Shyamsunder G, Raghuramulu N. Cestrum diurnum leaf as a source of 1, 25 (OH) 2 vitamin D3 improves egg shell thickness. J Steroid Biochem Mol Biol. 2004; 89-90(1-5): 589-94. doi: 10.1016/j.jsbmb.2004.03.101, PMID 15225844.
24. Botelho J, Machado V, Proença L, Delgado AS, Mendes JJ. Vitamin D deficiency and oral health: a comprehensive review. Nutrients. 2020;12(5):1471. doi: 10.3390/nu12051471, PMID 32438644.
25. Ahmad VU, Baqai FT, Fatima I, Ahmad R. A spirostanol glycoside from *Cestrum nocturnum*. Phytochemistry. 1991;30(9):3057-61. doi: 10.1016/s0031-9422(00)98252-9, PMID 1367796.
26. Jawale C, Kirdak R, Dama L. Larvicidal activity of *Oestrum nocturnum* on *Aedes aegypti*. Bangladesh J Pharmacol. 2010;5(1):39-40.
27. Begum AS, Goyal M, Mag P. Review Article Research and Medicinal Potential of the genus Cestrum (Solanaceae)-A Review. Pharmacogn Rev. 2007;1(2).
28. Pandey J, Rastogi R. Machiavellianism and ingratiation. J Soc Psychol. 1979;108(2):221-5. doi: 10.1080/00224545.1979.9711635.
29. Mazumder A, Bhatt A, Bonde V, Shaikh A, Mazumder R. Evaluation of *Cestrum nocturnum* for its anti-inflammatory and analgesic potentiality. J Herb Med Toxicol. 2010;4:113-17.
30. Zhong ZG, Zhao SY, Lv JY, Li P. Experimental study on antitumor effect of extracts from *Cestrum nocturnum in vivo*. Zhong yao cai= Zhongyaocai=Journal of Chinese Medicinal Materials. 2008;31(11):1709-12.
31. Kamboj A, Kumar S, Kumar V. Evaluation of antidiabetic activity of hydroalcoholic extract of *Cestrum nocturnum* leaves in streptozotocin-induced diabetic rats. Adv Pharmacol Sci. 2013; 2013:150401. doi: 10.1155/2013/150401, PMID 24151502.
32. Qadir MI, Al Murad MS, Ali M, Saleem M, Farooqi AA. Hepatoprotective effect of leaves of aqueous ethanol extract of *Cestrum nocturnum* against paracetamol-induced hepatotoxicity. Bangladesh J Pharmacol. 2014;9(2):167-70. doi: 10.3329/bjp.v9i2.17770.
33. Ünlü B. Herbal medicine and common dermatologic diseases. Herbal medicines. Elsevier; 2022. p. 329-45.
34. AYOUB M, SAEED S, AHMED A, AHMED M. Ethnobotanical survey and utilization of medicinal and food plants of Panjgur Balochistan, Pakistan. Asian J Ethnobiol. 2023;6(1). doi: 10.13057/asianjethnobiol/y060104.
35. Al-Reza SM, Rahman A, Ahmed Y, Kang SC. Inhibition of plant pathogens *in vitro* and *in vivo* with essential oil and organic extracts of *Cestrum nocturnum* L. Pestic Biochem Physiol. 2010;96(2):86-92. doi: 10.1016/j.pestbp.2009.09.005.
36. Bhattacharjee I, Chatterjee SK, Ghosh A, Chandra G. Antibacterial activities of some plant extracts used in Indian traditional folk medicine. Asian Pac J Trop Biomed. 2011; 1(2):S165-9. doi: 10.1016/S2221-1691(11)60148-2.
37. Bhattacharjee I, Ghosh A, Chandra G. Antimicrobial activity of the essential oil of *Cestrum diurnum* (L.) (Solanales: Solanaceae). Afr J Biotechnol. 2005;4(4):371-4.
38. الشريف ام. Pharmacological and preliminary phytochemical studies of *Cestrum nocturnum* on experimental animals. 2014.
39. Ahsaan M. Evaluation of *in vitro* Antioxidant and acetylcholinesterase Inhibitory Potential of Night Blooming Jasmine (*Cestrum nocturnum*); 2022.
40. Bhardwaj A, Singh A, Patnaik RS, Bhardwaj S. Phytochemical analysis of bioactive components of medicinal plants. J Pharm Neg Results. 2022:1138-43.
41. Aware CB, Patil DN, Suryawanshi SS, Mali PR, Rane MR, Gurav RG, *et al.* Natural bioactive products as promising therapeutics: a review of natural product-based drug development. S Afr J Bot. 2022;151:512-28. doi: 10.1016/j.sajb.2022.05.028.
42. Wu F, Zhou Y, Li L, Shen X, Chen G, Wang X, *et al.* Computational approaches in preclinical studies on drug discovery and development. Front Chem. 2020;8:726. doi: 10.3389/fchem.2020.00726, PMID 33062633.
43. Kane RC, Farrell AT, Sridhara R, Pazdur R. United States Food and Drug Administration approval summary: bortezomib for the treatment of progressive multiple myeloma after one prior therapy. Clin Cancer Res. 2006;12(10):2955-60. doi: 10.1158/1078-0432.CCR-06-0170, PMID 16707588.
44. Nasim N, Sandeep IS, Mohanty S. Plant-derived natural products for drug discovery: current approaches and prospects. Nucleus (Calcutta). 2022;65(3):399-411. doi: 10.1007/s13237-022-00405-3, PMID 36276225.
45. Huang L, Zhang X, Xiao H, YE H, Zeng J. Analgesic effect of *Cestrum nocturnum* L. extract on mice. Chin J Tissue Eng Res. 2006:172-4.
46. Khatun A, Rahman M, Nesa M, Looi CY, Wong WF, Hazni H, *et al.* Analgesic, anti-inflammatory and NF-κB inhibitory activity of aerial parts of *Cestrum diurnum*. Clin Phytosci. 2022;8(1):1-9.
47. Avijit M, Bhatt A, Bonde V, Shaikh A, Rupa M. Screening of the leaves of *Cestrum nocturnum* for its antipyretic. Niger J Nat Prod Med. 2009;13(1):36-40. doi: 10.4314/njnpm.v13i1.61586.
48. Shaheen S, Sarwar S, Harun N, Khalid S, Hussain K, Khan F. Quantitative ethnomedicinal survey of shrubby plants, used by the local communities of district Lahore (Punjab), Pakistan. bioRxiv. 2020;06:18.158865.
49. Mahmoud SN, Al-Ani NK. Effect of different sterilization methods on contamination and viability of nodal segments of *Cestrum nocturnum* L. Int J Res Stud Biosci. 2016;4(1):4-9.
50. Ghosh A, Rawani A, Mondal RP, Chandra G. Mosquito larvicidal and antimicrobial activities of synthesized silver nanoparticles (AgNP) using mature fruit extract of *Cestrum diurnum* L. Indian J Nat Prod Resour (IJNPR)[Formerly Natural Product Radiance (NPR)]. 2022;12(4):592-9.
51. Nagar HK, Srivastava AK, Srivastava R, Kurmi ML, Chandel HS, Ranawat MS. Pharmacological investigation of the wound healing activity of *Cestrum nocturnum*

(L.) ointment in Wistar albino rats. J Pharm (Cairo). 2016; 2016:9249040. doi: 10.1155/2016/9249040, PMID 27018126.

52. Ahmad SF, Khan B, Bani S, Suri KA, Satti NK, Qazi GN. Amelioration of adjuvant-induced arthritis by ursolic acid through altered Th1/Th2 cytokine production. Pharmacol Res. 2006;53(3):233-40. doi: 10.1016/j.phrs.2005.11.005, PMID 16406805.
53. Keshari AK, Srivastava R, Singh P, Yadav VB, Nath G. Antioxidant and antibacterial activity of silver nanoparticles synthesized by *Cestrum nocturnum*. J Ayurveda Integr Med. 2020;11(1):37-44. doi: 10.1016/j.jaim.2017.11.003, PMID 30120058.
54. Majak W. Review of toxic glycosides in rangeland and pasture forages. Rangeland ecology & management. J Range Manag Arch. 2001;54(4):494-8.
55. Khan AU, Akram M, Daniyal M, Akhter N, Riaz M, Akhtar N, *et al.* Awareness and current knowledge of epilepsy. Metab Brain Dis. 2020;35(1):45-63. doi: 10.1007/s11011-019-00494-1, PMID 31605258.
56. Jawale C, Dama L. Insecticidal potential of Cestrum sp. (Solanaceae: Solanales) against *Tribolium castaneum* and *Tribolium confusum* (herbst)(Coleoptera-Tenebrionidae). Int J Respir. 2010;3:155-61.
57. Ghosh A, Chandra G. Biocontrol efficacy of *Cestrum diurnum* L. (Solanaceae: Solanales) against the larval forms of *Anopheles stephensi*. Nat Prod Res. 2006;20(4):371-9. doi: 10.1080/14786410600661575, PMID 16644532.
58. Valencia-Mejía E, León-Wilchez YY, Monribot-Villanueva JL, Ramírez-Vázquez M, Bonilla-Landa I, Guerrero-Analco JA. Isolation and identification of pennogenin tetraglycoside from *Cestrum nocturnum* (Solanaceae) and Its antifungal activity against *Fusarium kuroshium*, causal agent of Fusarium Dieback. Molecules. 2022;27(6):1860. doi: 10.3390/molecules27061860, PMID 35335224.
59. Sridhar T, Josthna P, Naidu C. Antifungal activity, phytochemical analysis of *Solanum nigrum* (L.)-an important antiulcer medicinal plant. J Ecobiotechnology. 2011;3(7).
60. RASHED K, Zhang XJ, Luo MT, Zheng YT. Evaluation of anti-HIV-1 activity from *Cestrum nocturnum* aerial parts and phytochemical analysis; 2013.
61. Wu DP, Lin TY, Lv JY, Chen WY, Bai LR, Zhou Y, et al. *Cestrum nocturnum* flower extracts attenuate proliferation and induce apoptosis in malignant cells through inducing DNA damage and inhibiting topoisomerase II activity. Evid Based Complement Alternat Med. 2017; 2017:1456786. doi: 10.1155/2017/1456786, PMID 28250789.
62. Manzoor A, Qaisar U, Parveen Z, Siddique S, Sardar AA, Ishaq N. *In vitro* anticancer and antioxidant potential of Cestrum species. Pak J Pharm Sci. 2020;33(4):1535-41. PMID 33583784.
63. Bandi LP, Acharya S, Hegde V. Clinical efficacy of Dinamallika (*Cestrum diurnum*) in kitibha kustha (poriasis). Ayurpharm Int J Ayur Alli Sci. 2018;7:101-8.
64. Halim AF, Collins RP, Berigari MS. Alkaloids produced by *Cestrum nocturnum* and *Cestrum diurnum*. Planta Med. 1971;20(1):44-53. doi: 10.1055/s-0028-1099663, PMID 5154603.
65. Mimaki Y, Watanabe K ando Y, Sakuma C, Sashida Y, Furuya S, *et al.* Flavonol Glycosides and Steroidal Saponins from the Leaves of *Cestrum nocturnum* and Their Cytotoxicity. Journal of Natural Products. 2001;64(1):17-22.
66. Haggag MI. Phytochemical profile for *Cestrum nocturnum* leaves ethanolic extract and isolation of a rare flavonoid using different chromatographic and spectroscopic techniques. J Med Plants Stud. 2022;10(2):143-50. doi: 10.22271/plants.2022.v10.i2b.1403.
67. Doshi GM. Pharmacognostic quantification of flavonoids by high performance thin layer chromatography and *in vitro* cell line study on developed herbal formulation from *Cestrum nocturnum* plant extract. Int J Green Pharm (IJGP). 2016;10(03).
68. RASHED KN. Investigation of antioxidant activity from *Cestrum nocturnum* L. stems and phytochemical content. 2013.
69. Chaskar PK, Tank SH, Doshi GM. Gas chromatography-mass spectroscopy studies on *Cestrum nocturnum* macerated methanolic extract. Asian J Pharm Clin Res. 2017;10(3). doi: 10.22159/ajpcr.2017.v10i3.16134.
70. Mimaki Y, Watanabe K, Sakagami H, Sashida Y. Steroidal glycosides from the Leaves of *Cestrum nocturnum*. J Nat Prod. 2002;65(12):1863-8. doi: 10.1021/np020276f, PMID 12502329.
71. Mohamed KM, Fouad MA, Matsunami K, Kamel MS, Otsuka H. A new norlignan glycoside from *Cestrum diurnum* L. Arkivoc; 2007(13):63-70. doi: 10.3998/ark.5550190.0008.d09.
72. Begum A, Angella P, Basha SA, Raghavendra G, Pandey S, Sarma B. Effect of leaf extracts and steroidal saponin of *Cestrum diurnum* L. on spore germination and mycelial growth of some fungi. Electron J Environ Agric Food Chem. 2011;10(11):3097-103.
73. Fouad MA, Mohamed KM, Kamel MS, Matsunami K, Otsuka H. Cesdiurins I-III, steroidal saponins from *Cestrum diurnum* L. J Nat Med. 2008;62(2):168-73. doi: 10.1007/s11418-007-0211-2, PMID 18404318.

Cite this article: Fakhrah S, Mohanty CS, Kumari A. The Current Status and Challenges of Two Overlooked Medicinal Plants *Cestrum diurnum* and *Cestrum nocturnum*: A Review. Pharmacog Rev. 2024;18(36):101-10.