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Comprehensive Review of Phytochemical Content and Applications from *Cestrum nocturnum*: A Comparative Analysis of Physicochemical Aspects

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: The term phytochemicals are plant-produced chemicals that are generated by primary or secondary metabolism. These are chemicals of plant origin. They have biological activity. The plant *Cestrum nocturnum* has great medicinal value. The phytochemicals such as

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proteins, amino acids, glycoside, phenolic compounds, and tannins can have been determined from this plant.
Aims: Our goal is to describe phytochemical contents from *Cestrum nocturnum* and its application and significance in various purposes.
Methodology: This investigation is done by using conventional extraction as well as microwave-assisted extraction.
Results: The results show that the *Cestrum nocturnum* has different reactivity according to the pH of different materials present. The total ash content showed the presence of inorganic compounds. The ash content can be found to be 13.4%. The qualitative analysis revealed the presence of alkaloids, glycosides, saponins, and flavonoids in the species. It also contains many volatile compounds such as linalool (3.1%), benzaldehyde (2.5%), benzyl alcohol (2.4%) and many others. It also contains many antioxidant properties.
Conclusions: The plant is cultivated as a medicinal plant. The extracts can be screened for biological activity and aqueous extract against *E. coli, B. subtilis, S. typhi, S. aureus*, tuberculosis, and malaria.

Keywords: Alkaloids; Cestrum nocturnum; phytochemicals; steroid; terpenoid.

1. INTRODUCTION

Phytochemicals are ingredients derived from plants; chemicals produced by plants during their metabolism are known as phytochemicals [1]. They generally exhibit biological activity within the plant host and aid in the growth of the plant or its defence against invaders, diseases or competitors. Since there is currently insufficient evidence to support their potential health benefits, phytochemicals are typically considered research compounds rather than necessary nutrients and constituents [1]. phytochemicals can be divided into three main groups: flavonoids, lignans, carotenoids and polyphenols which are found in crude phenolic acids. Based on their similar chemical structures, flavonoids can be further classified as anthocyanins, flavones, flavanones, isoflavones and flavonols. Proanthocyanins, epicatechins and catechins are additional classifications for flavanols [2]. More than 25,000 phytochemicals have been found in total. These phytochemicals are typically concentrated in the vibrant sections of plants, such as whole grains, fruits, vegetables, nuts, and legumes. When studying phytochemicals, phyto-chemists first extract and isolate the constituents from the source plant, then define their structure or test them in vitro experiments, in vivo studies involving lab animals, or cell cultures. Difficulties in that area include separating particular compounds, figuring out their frequently intricate structures and figuring out which particular phytochemical is principally in charge of a given biological activity [2-3]. The phytochemical category involves compounds that are recognized as essential nutrients that are naturally contained in plants and are required for normal physiological functions, so they must be obtained from the diet of humans [3]. Some phytochemicals are recognized phytotoxins that are toxic to humans; for example, aristolochic acid is carcinogenic at low doses ranges. Some phytochemicals are antinutrients that interfere with the absorption of nutrients such as some polyphenols and flavonoids might be pro-oxidants in high ingested amounts [3]. Phytochemicals are a wide variety of nonnutritive chemical compounds found in plant foods that may have health effects. A few examples of well-known phytochemicals are flavonoids, phenolic acids, isoflavones, curcumin, isothiocyanates and carotenoids [4-6]. A species of plant in the potato family Solanaceae is called *Cestrum nocturnum*, also known as the lady of the night, night-blooming jessamine, night-scented jessamine, night-scented cestrum or poisonberry. Though it was naturalized in South Asia, its origins are in the West Indies. Although *Cestrum nocturnum* is thought to be native to America, it has been cultivated for its potent flower scent and has spread throughout the new and old-world tropical regions, particularly the Pacific. It has even become invasive in many of these areas. It has been noted as widespread throughout Mesoamerica (gentry and d'Arcy, 1986) [7]. The species was previously thought to be native to only South America. While Acevedo-Rodriguez and Strong (2012) listed the species as exotic, PIER (2014) and USDA-ARS (2014) listed it as native to Cuba, and Hanelt et al. (2001) merely noted that it was a cultivated plant species. The species is widely distributed throughout the Pacific region of the Old World's tropics and is known to be invasive on numerous islands. According to reports, it is only grown for

ornamental purposes in China and Singapore and it is a common ornamental cultivation in India [8-9]. *Cestrum nocturnum* is a woody, evergreen shrub that can reach a height of 4 meters (13 feet). Simple, narrow, lanceolate leaves with an entire margin that are smooth and glossy measure 6–20 cm (2.4–7.9 in) long and 2–4.5 cm (0.79–1.77 in) wide. The greenish-white flowers have a thin, tubular corolla.Produced in cymose inflorescences, they are 1-2.5-2.5 cm (0.79-0.98 in) long with five acute lobes, and 10-13 mm (0.39-0.51 in) in diameter when open at night. It releases a strong, sweet scent at night [9]. The fruit is a berry that is either auberge-colored or Marfil white, measuring 10 mm (0.39 in) in length and 5 mm (0.20 in) in diameter. A variety of yellowish flowers are also present. Regarding the toxicity of fruit and foliage, reports vary [10-11].

The life cycle of *Cestrum nocturnum* are shown in Fig. 1, [11-13]. Many active ingredients found in the leaves have been used world-wide as a treatment for tropical psoriasis. Practitioners of ayurveda have also begun to express interest in the plant. Its leaves are applied externally to relieve skin patches, psoriasis and itching. Malaria can be effectively treated with its oil in many african nations [11-12]. Despite being poisonous, leaves contain several active substances with therapeutic qualities. Additionally, the plant exhibits cardioactive and larvicidal properties [12-13]. Its leaves have long been used to treat burns and swellings. Because of its volatility and ability to ward off mosquitoes, the oil has been used to treat malaria in numerous african nations. Epilepsy is also treated with it. Pharmacological research has demonstrated that it possesses analgesic, diuretic, antiviral and abortive qualities and to treat arterial hypertension [12-14]. These contain sources of ingredient of essence oil such as phenyl ethyl alcohol (27%), benzyl alcohol (12%), caryophyllene oxide (3.1%), eicosane (5.6%), eugenol (5.6%), n-tetracosane (4.4%), 1-hexadecanol (2.7%), methoxy eugenol (2.45%) and benzaldehyde (2.32%) are all present in flowers distilled oil [14]. Cytotoxic steroids are present in flower alcohol extract [15-18].

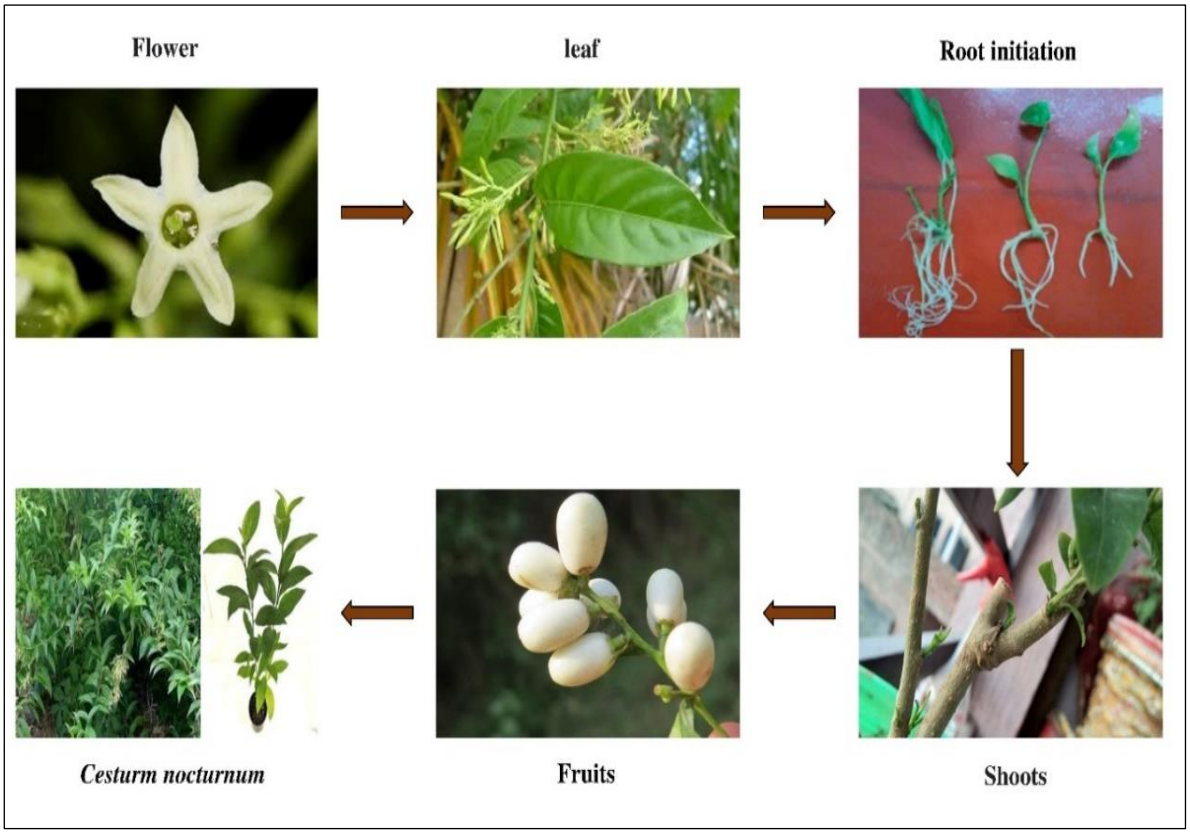

Fig. 1. Life cycle of *Cestrum nocturnum*

2. MATERIALS AND METHODS

2.1 Plant Collection and Identification

Fresh plant samples can be collected from Islamic University, Kushtia-7003, Bangladesh. Species identification can be accomplished by comparison with verified herbarium specimens which can then be verified using diagnostic keys and morphological descriptions found in different floras. The portions that will be useful for the investigation leaves, stems etc will be separated and stored.

2.2 Anatomical Study

After being trimmed to the proper dimensions, the stems and leaves of both plants can be fixed in F.A.A. (formalin, acetic acid-alcohol 1:1:18). Hand sections require a sharp blade for cutting [16]. Safranin and fast green will be used to stain thin transverse sections which will subsequently be passed through alcohol grades to dehydrate them before being mounted in D.P.X.

Through the use of a light microscope, observations are made from these sections. Additionally, these sections are photomicrographic. It is necessary to research and identify the plant part(s)' unique identifying characteristics [17].

2.3 Phytochemical Study

After five minutes of washing the leaves in a 5% mercuric chloride solution to get rid of any impurities, they can be shade-dried, baked and ground into a fine powder [18]. In a rotating evaporator filled with distilled water, ethanol and methanol, the solvent extracts must be evaporated until they are completely dry. The resulting dried residues must be stored at -4°C in screw-capped vials [18]. The following techniques could be used to conduct phytochemical studies.

2.3.1 Test for alkaloids

2.3.1.1 Hager's test

Hager's reagent (saturated picric acid solution) must be added to the test solution. The presence of alkaloids will be indicated by the formation of yellow precipitate [19-20].

2.3.1.2 Mayer's reagent and Wagner's reagent

After warming the plant extract in 2% H_2SO_4 for two minutes, it will filter and a few drops of each reagent will be added individually [21].

a) Mayer's reagent: There were alkaloids present as a creamy white precipitate [22].

b) Wagner's Reagent: The appearance of a reddish-brown precipitate further indicates that the extract contains alkaloids [22].

2.3.2 Test for tannins

When the extract is combined with a simple lead acetate solution, the presence of tannins is indicated by the formation of a white precipitate [21].

2.3.3 Test for cardiac glycosides

A few drops of $FeCl_3$ and concentrated H_2SO_4 are added to the extract solution in glacial acetic acid solution to see the reddish-brown colouration at the intersection of the two layers and the bluish-green colour in the upper layer [23].

2.3.4 Test for saponins

Test for foaming: 20 ml of water is mixed with about 5 ml of filtrate and the mixture is shaken hard. When standing, a steady fourth will indicate the presence of saponins [24].

2.3.5 Test for steroids and terpenoids

0.5 ml of acetic anhydride and 0.5 ml of chloroform will be used to treat 4 mg of extract. After that, a concentrated H_2SO_4 solution must be added [25]. For terpenoids, this will result in a reddish-violet color and for steroids, a greenish-bluish color [25].

2.3.6 Test for flavonoids

2.3.6.1 Ferric-chloride test

After adding a few drops of $FeCl_3$ solution to the extract, it formed a black colour which indicated the presence of flavonoids [26].

2.3.6.2 Lead-acetate solution test

A few drops of a 10% lead acetate solution were added to the extract, causing a yellow precipitate that suggested the presence of flavonoids [27].

c) High-Performance Liquid Chromatography

HPLC (Shimadzu, 2LC-10 ATVP pumps, SPD-10AVP, UV-visible detector, Rheodyne injector with 50 L loop) can be used to analyze methanolic leaf extracts. Software called Shimadzu LC-solution version 6.42 is used to collect and handle the data [28]. The mobile phase will consist of 4% aqueous acetonitrile with 0.1% (v/v) phosphoric acid buffered to pH 3.5 using triethylamine and a Phenomenex C18 column (250mm × 4.6mm, I.D., 5μm). The mobile phase needs to be degassed by sonication for ten minutes after being filtered through a 0.22 μm membrane filter. The injection volume will be set to 20 μL and 260 nm will be used for detection [28].

2.4 Isolation of the Essential Oil

The air-dried flower parts (200 g) of *Cestrum nocturnum* can be subjected to hydro-distillation for 3.0 hours using a Clevenger-type apparatus [28].

2.5 Preparation of Organic Extracts

The air-dried flower parts (50 g) of *Cestrum nocturnum* can be extracted with n-hexane, chloroform, ethyl acetate and methanol separately at room temperature and the solvents can be evaporated by vacuum rotary evaporator. The extraction procedure has to yield hexane (7.5 g), chloroform (6.6 g), ethyl acetate (5.4 g) and methanol (6.3 g) extracts which are then lyophilized and kept in the dark at 4°C [29-38].

2.6 Antioxidant Activity

2.6.1 DPPH radical scavenging activity

The ability of antioxidants derived from natural sources, like fruit and plant extracts, to scavenge free radicals is commonly evaluated using the relatively stable radical DPPH [38]. The capacity of several *C. nocturnum* leaf extracts, at varied concentrations, to scavenge DPPH iterated as a percentage of inhibition in Table 2, 2-diphenyl-1-picrylhydrazyl, or DPPH for short, is a stable free radical that is frequently used to gauge a substance's antioxidant capacity [38].

$$\% \text{ DPPH} = \frac{\Delta Absorbance\ of\ control - \Delta Absorbance\ of\ sample}{\Delta Absorbance\ of\ sample} \times 100$$

To evaluate the extracts' capacity to quench DPPH radicals using the technique outlined by Brand-Williams et al. [39].

2.6.2 ABTS radical scavenging activity

2.45 mM potassium persulfate was added to create the ABTS stock solution (7 mM). Before the experiment, the solution was suitably diluted to yield an absorbance of 0.70 at 734 nm. Different concentrations of extract were added to a 100 µL volume [40]. The combinations were added to 900 µL of ABTS solution and incubated for 30 minutes at 37°C. Using ascorbic acid as the standard, the 734.0 nm absorbance was measured using an Eppendorf Bio-spectrophotometer [40]. The formula utilized to determine the percentage of inhibition was identical to the one employed for DPPH.

3. CHARACTERIZATION

Different techniques were employed to investigate in this review manuscript that is illustrated [16-40].

4. RESULTS AND DISCUSSION

Samreen Fatema et. all 2019, studied on phytochemical properties of conventional aqueous extract and microwave-assisted extract of *Cestrum nocturnum* leaves [41-42,44-49]. It is possible to analyze the phytochemical, physicochemical and biological characteristics of *Cestrum nocturnum* leaves. The powder sample needs to be treated with various chemicals and registered colour changes. Table 1, presents the findings. Different colours will be produced by the solutions. Inorganic compounds were evident in the ash content. It is discovered that *Cestrum nocturnum* leaves have a total ash content of 13.4%. It was discovered that 50% of the ash was water soluble and that 22% of the ash was insoluble in 1.0 M hydrochloric acid. The following Tables 1 and 2, display the condensed characteristics of the ash derived from *Cestrum nocturnum* leaves.

Different techniques were used but the same solvent was used to extract the leaves of *Cestrum nocturnum*. There was a discernible difference between microwave-assisted extraction (MAE) and conventional extraction (CE). Although the percentages from the two extractions were nearly identical, the MAE is more practical as it provides the same percentage in less than 30.00 minutes illustrated in Table 3.

Nishtha et. al. 2023, studied phytochemical analysis and anatomical study of

Cestrum nocturnum in Table 3. Different phytochemical constituents analyzed from *Cestrum nocturnum* are given below in Table 4. The qualitative analysis revealed the presence of alkaloids, glycosides, saponins and flavonoids in the species [42].

Amin Shaista et al. 2020, studied the Chemical analysis of *Cesturm nocturnum*. The phytochemicals like alkaloids, glycosides, saponins, flavonoids, terpenoids, steroids and tannins showed positive results for all extracts but tannins showed negative results in the case of aqueous and methanol extracts [42-44].

The total antioxidant capacity was highest in leaf extracts, indicating strong antioxidant activity in these extracts, possibly due to the presence of phenolic compounds [45]. Phytochemicals, including alkaloids and flavonoids, found in many plants can exhibit antimicrobial properties expressed in Table 5. These compounds may help protect the plant from pathogens and could have implications for medicinal use in humans [44, 50].

The phytoconstituents of various parts of the *Cestrum nocturnum* plant are described in Table 6. The significance of the alkaloids found in leaves steams and volatiles are presented on flowers. *Cestrum nocturnum*, which is among the most important Solanaceae genera, was used as a folk remedy. It is characterized by phytochemical, pharmacological, and morphological properties [75].

As indicated in Table 7, the volatile constituents of *C. nocturnum* were inquisition using GC and GUMS combined with GC-sniffing technique. The concentration which is higher than 1% is the main constituents (linalool (3.1%), benzaldehyde (2.5%), benzyl alcohol (2.4%), phenylacetaldehyde (2.4%), cis-jasmone (2.1%), benzyl acetate (1.8%), phenol (1.6%), methyl jasmonate (1.5%), 1,8-cineole (1.4%), borneol (1.3%), eugenol (1.3%), linalyl acetate (1.2%) and citronellyl propionate (1.1%). Here we found many other compounds that are accountable for the beautiful, enchanting odor. An aspect seems that the most abundant compounds contain constituents ranging between 0.1% to 3.0% with linalool at 3.1%. In addition, fatty acids and their esters are responsible for this attractive odour. With the help of the GC-sniffing technique, it was determined that a concentration of more than 1% is responsible for this aromatic characteristic. The jasmine-like aroma also occurred for some of these volatile compounds. This result can be significantly compared with the odour characterization of the single compounds which identified that some showed fresh floral impressions. Overall, there are significant varieties within this study and the anterior inquisition [51-53]. The extraction methods of oils, developmental stages, climate, geographical conditions and the existence of different varieties of *C. nocturnum* can be responsible for these disparities [43,74]. The proportion of treatment was significantly impacted by the interaction between plant type as well as oil concentration [76, 83].

Table 1. The leave powder shows the following fluorescent test

Sr. No.	Solutions	Observation	Reference	Sr. No.	Solutions	Observation	Reference
1	The powder as such (P)	Dark green	[41]	7	P + Ammonia	Cream	[39,41]
2	P + n-butanol	Whitish green	[41-42]	8	P + Glacial Acetic Acid	Fluorescent green	[41, 55, 76]
3	P + conc. HCl	Red	[38, 41]	9	P + 1N HCl	Cream	[41]
4	P + conc. HNO_2	Dark orange	[41, 43]	10	P + 1N NaOH	Yellowish green	[41-43]
5	P + conc. H_2SO_4	Blackish brown	[41-42]	11	P + 5% HCl	Creame	[41]
6	P + Ethanol	Whitish green	[41]	12	P + 5% NaOH	Yellowish	[38, 41-45]

Table 2. The leave powder shows the following ash analysis and densities

Sl. No.	Ash	Results	Reference
1	Total ash content	13.5 %	[39, 41]
2	Water soluble content	50.01 %	[40]
3	Acid insoluble content	22.01 %	[40-41]
4	Bulk density content	0.387 g mL^{-1}	[41]
5	Tab density	0.502 g mL^{-1}	[41-42]
6	Housner ratio	1.2926	[42]
7	Carrs index	22.6 %	[40-44]

Table 3. Phytochemical analysis of the leave extract of *Cestrum nocturnum*

Sr. No.	Reagent	CE	MAE	Reference
Alkaloids Detection				[42, 46]
i.	Mayer`s test	-ve	-ve	
ii.	Wagner`s test	+ve	+ve	
iii.	Hager`s test	+ve	+ve	
Carbohydrate Detection				[42-43]
i.	Molish test	+ve	+ve	
ii.	Fehling`s test	+ve	+ve	
iii.	Benedic test	-ve	-ve	
iv.	Barfoad`s test	+ve	+ve	
Glycosides Detection				[43,45]
i.	Borntrager`s test	-ve	-ve	
ii.	Legal`s test	-ve	-ve	
iii.	Saponins	+ve	+ve	
Proteins and Amino acid Detection				[42-43]
i.	Millon`s test	+ve	-ve	
ii.	Nitric acid test	-ve	+ve	
iii.	Biuret test	+ve	+ve	
iv.	Ninhydrine test	-ve	-ve	
Phenolic compound and tannin Detection				[43,47]
i.	Ferric chloride test	-ve	-ve	
ii.	Gelatin test	+ve	+ve	
iii.	Lead acetate test	+ve	+ve	
iv.	Alkaline reagent test	+ve	+ve	

Table 4. Phytochemical studies on the leaf extract of *Cestrum nocturnum*

Phytochemicals	Aqueous	Ethanol	Methanol	Reference
Alkaloids	+	+	+	[42, 49, 62]
Glycosides	+	+	+	[43, 48]
Saponins	+	+	+	[43, 69]
Flavonoids	+	+	+	[42, 52]
Terpenoids	+	+	+	[44, 66]
Tannins	-	+	-	[42, 49]
Steroids	+	+	+	[46, 48, 52]

Table 5. The phytochemical studies on stems, leaves and flowers of *Cestrum nocturnum*

Item	Various Plant parts			Reference
	Mean value ± SE			
	Stems	Leaves	Flowers	
Total phenolic (mg/gm GAE)	3.01 ± 0.08	3.16 ± 0.07	3.75 ± 0.1	[28, 43, 49, 62]
Total flavonoid (mg/gm QE)	1.25 ± 0.03	1.98 ± 0.12	2.19 ± 0.2	[41, 43, 62]
Total tannin (%)	3.21 ± 0.18	3.44 ± 0.25	3.04 ± 0.13	[43, 48, 51]
Total saponin (%)	3.08 ± 0.13	3.03 ± 0.16	2.03 ± 0.03	[5, 43-45]
Total alkaloid (%)	1.32 ± 0.05	1.76 ± 0.07	1.27 ± 0.09	[3, 42-45]

Table 6. The phytoconstituents of various parts of the *Cestrum nocturnum* plant

Sl. No.	Phytoconstituents	Plant Part	Reference
1	Carbohydrates	Flower and Stem	[29, 43]
2	Glycosides: Pregnane glycosides, Cholestane glycosides, a Pregnane-Carboxylic acid ç-Lactone glycoside, Nocturnoside A and Nocturnoside B, Phenol glucosides	Leaves	[30, 49]
3	Triterpenes and sterols: Quassinoids	Stems	[17, 43-52]
4	Coumarins	Aerial parts	[43-53]
5	Alkaloids	Leaves and Stems	[36-42]
6	Flavonoids	Stems	[43-45]
7	Tannins	Stems	[22, 42-43, 48-52, 67]
8	Volatiles	Flower	[43-45]
9	Saponins: Pseudo-furostanol saponin, Spirostanol saponin, Furostanol saponin,	Stems	[11, 41-46]

Table 7. Various volatile oils from the *Cesturm nocturnum* plant

Sl. No.	Compound	Percentage	Odor description	Reference
1	Acetaldehyde	0.2%	Pungent, penetrating	[31-47]
2	Acetaldehyde diethyl acetal	0.1%	Fresh, fruity green	[30-47]
3	Acetic acid	0.4%	Stinging, sour	[36-43]
4	Acetophenone	0.3%	Pungent, sweet(acacia)	[7, 47]
5	2-acetyl furan	0.4%	Balsamic-sweet	[47]
6	Amyl alcohol	0.1%	Fusel-like	[8, 47]
7	Amyl benzoate	0.2%	Balsamic-sweet	[47]
8	Benzaldehyde	2.5%	Biter almonds	[31, 36]
9	Benzoic acid	0.6%	Odorless, faint-balsamic	[47]
10	Benzophenone	0.4%	Powdery rose, geranium	[6, 47]
11	Benzyl acetate	1.8%	Sweet, floral, fresh	[61]
12	Benzyl alcohol	2.4%	Pleasant, fruity-floral	[36-39]
13	Benzyl butyrate	0.2%	Heavy, fruity-floral	[47]
14	Benzyl phenylacetate	0.4%	Sweet, honey-floral	[47]
15	Borneol	1.3%	Camphor, woody-peppery	[47]
16	Benzyl acetate	1.8%	Ethereal-fruity	[9, 47]
17	Camphor	0.8%	Penetrating, warm-minty	[31]
18	B-caryophyllene	0.3%	Woody-spicy, dry	[11, 47]
19	1,8-cineole	1.4%	Fresh, camphoraceous	[47]
20	Citronellal	0.4%	Lemon, citronella, rose	[31, 36, 47]

Sl. No.	Compound	Percentage	Odor description	Reference
21	Citronellol	0.7%	Fresh, rose	[47]
22	Citronellyl acetate	0.6%	Fresh, rosy, fruity	[47]
23	Citronellyl propionate	1.1%	Fresh, fruity, sweet rosy	[39, 62]
24	3-decen-3-one	0.6%	Fruity-floral, jasmine	[36]
25	Dihydrojasmone*	0.9%	Floral, fresh, fruity	[47, 70]
26	Dihydrojasmone lactone*	0.4	Heavy floral, fatty waxy	[47]
27	Hexanol	0.5%	Fatty-fruity	[31]
28	Dodecanal	0.3%	Waxy-herbaceous, floral	[12, 47]
29	Ethyl alcohol	0.9%	mild sweet-ethereal	[47]
30	Eugenol	1.3%	Warm spicy, clove	[14, 47]
31	Farnesene*	0.3%	Mild, sweet, warm	[63]
32	Farnesol*	0.2%	Flowery, mild, sweet	[47]
33	Geraniol	0.3%	Green-floral, rose	[31]
34	Geranyl acetate	0.4%	Sweet, fruity-floral, rosy	[47, 74]
35	Heptanal	0.2%	Fatty, harsh, pungent	[64]
36	Heptanal diethylacetal	t	Fresh, herbaceous	[31, 40]
37	Heptanoic acid	0.5%	Fatty-rancid, sweet sour	[55]
38	Heptyl acetate	0.1%	Pleasant, sweet	[13, 47]
39	2-(heptyl)-tertrahydrofuran	t	Fruity-floral	[47]
40	Hexanal	0.6%	Fruity, fatty-green	[47]
41	Linalool	3.1%	Refreshing, floral-woody	[64, 71, 70, 74]
42	Phenylacetaldehyde	0.4%	Harsh-green, hyacinth	[16, 47]
43	Cis-jasmone	2.1%	Fruity fresh, jasmine, warm spicy	[47]
44	Phenol	1.6%	Harsh, pungent	[57]
45	Methyl jasmonate	1.5%	Sweet, floral, jasmine	[15, 65]
46	Neryl acetate	0.4%	Fruity, floral, rosy	[47]
47	Nerol	0.7%	Fresh, sweet, rose	[47, 65]
48	α- phellandrene	9.1%	Fruity	[31]
49	β-phellandrene	12.2%	Floral,sweet	[66]
50	(E)-β-ocimene	9.1%	Refreshing	[17, 47]
51	Octyl acetate	t	Fruity	[19-20, 36]

Table 8. Antioxidant activity of *Cesturm nocturnum* leaf extract

The activity	Plant extract/Standard	IC_{50} (µg/mL)	Reference
DPPH	n-Hexane	185 ± 0.71	[49, 52]
	DCM	NS	[52-53]
	Ethyl acetate	NS	[53, 68]
	Methanol	39.11 ± 0.53	[52, 65]
	Aqueous	NS	[52, 67]
	Ascorbic acid	15.12 ± 0.7	[46, 52, 72]
ABTS	n-Hexane	79.13 ± 0.52	[51, 66]
	DCM	NS	[52, 63-65]
	Ethyl acetate	50.42 ± 0.76	[57]
	Methanol	20.94 ± 0.85	[54, 68]
	Aqueous	56.73 ± 0.66	[52, 70, 73]
	Ascorbic acid	22.77 ± 0.43	[69]

IC_{50} values are a measure of the potency of a compound in inhibiting a specific biological activity. In this study, IC_{50} values were determined for the inhibitory activity of Cestrum nocturnum leaf extracts against DPPH and ABTS

Table 8, the antioxidant activity of extracts from *Cestrum nocturnum* leaves was assessed using the DPPH assay with the methanol extract showing the highest potency in neutralizing the DPPH radical while ascorbic acid served as the reference standard. In the current study, *C. nocturnum* leaves were gradually extracted using n-Hexane, DCM, EtO-Ac, MeOH and water. The phytochemical screening results show that bioactive compounds like flavonoids and polyphenols are significantly concentrated in the MeOH extract (Table 2), which are recognized for their capacity to squelch free radicals. Reductases function as antioxidants by contributing hydro-free radicals to gen atoms and their concentration is correlated with the reducing power of the antioxidant properties of extracts [52-55]. The MeOH extract showed noteworthy (Table 5) total antioxidant activity. These outcomes are consistent with those from earlier research [14, 44, 56, 57]. Additionally, a newly released study showed that *C. nocturnum* leaves are abundant in phytochemical components [56]. The antioxidant capacity of the MeOH extract may be attributed to poly-phenolic components as phenolic compounds are thought to account for most of the antioxidant capabilities of plant extracts [58-59]. Certain chronic diseases can be stopped or their course can be delayed by compounds that can quench free radicals and reduce oxidative stress [60-63]. Strong DPPH and ABTS radical quenching ability was demonstrated by the methanol extract of *C. nocturnum* leaves (Table 5), demonstrating the plant's antioxidant activity. These findings concur with previously released reports [64-65]. It has significant neuroprotective activity [77].

5. SIGNIFICANCE APPLICATION AREA

The utmost applications are described in Table 9 which expresses the impact of human life as well as other fields of specialization.

Table 9. The specific area illustrated below

Sl. No.	Medicinal uses	Reference
1	It is used in epilepsy treatment.	[66]
2	The leaves had strong bactericidal and analgesic properties.	[36], [67]
3	One uses the volatile oil to ward off mosquitoes.	[22]
4	It is used to treat malaria in African nations.	[31]
5	The plant has an anaesthetic effect, an inhibitory effect on the central nervous system, and a cardiac athymic effect.	[68]
6	It contains many antioxidants including beta-carotene, lutein, zeaxanthin, lycopene, alpha-tocopherol, and phytosterols. These fight against free radicals and cell damage are protected which are protected by oxidation.	[69]
7	It can improve heart health.	[69]
8	The presence of antioxidants helps to lower cholesterol levels.	[69]
9	It may also help prevent cancer.	[69]
10	It is also known as boost immunity.	[69]
11	It is used for the treatment of allergies, asthma, bronchitis, and sinus problems.	[69]
12	This also promotes sleep because of its aromatic characteristics.	[69]
13	It helps to feel more relaxed and calmer.	[69]
14	It contains volatile oils that are worked as natural insect repellents.	[69]
15	It is also effective against dengue fever, yellow fever, West Nile virus, and encephalitis.	[69]
16	The plant has been used for centuries to treat fever, colds, coughs, flu, sore throat, and respiratory infections.	[69]
17	This flower fragrance and essential oil also help to reduce stress and anxiety.	[69]
18	It is an excellent source of vitamins (A, B, C, D, E, K), iron, magnesium, calcium, potassium, sodium, zinc, copper, manganese, selenium and fibre.	[69]
19	Ethanolic extract from *C.nocturnum* leaves has a wound-healing effect and is prepared as an ointment.	[69]
20	It has a high rate of wound contraction.	[69]

Sl. No.	Medicinal uses	Reference
21	n-butanol and polysaccharide extracts of *C. nocturnum* can restrict tumor growth.	[70]
22	The dry leaf powder of the plant carried analgesic activity and psychoactive activity.	[70]
23	Green synthesis of silver nanoparticles has strong antioxidant activity along with antibacterial activity.	[70]
24	It has very effective results in diabetes treatment.	[70]
25	It also induced damage to the cancer cell DNA and restricted toxicity.	[70]
26	The volatile oil of this plant and flowers helps to increase serotonin levels in the brain.	[70]
27	Helpful in treating liver disorders, and skin eruptions.	[70]
Sl. No.	**Traditional uses**	**Reference**
1	*C.nocturnum* flowers are used by Hindu religious people for offering their God Shiva and Ganesh in Kathmandu.	[71]
2	Nepalese shamans make ceremonial incense out of leaves and fresh flowers. To strengthen their spiritual healing energies, they consume fresh flowers.	[71]
3	In the West Indies, as a stupefying charm medicine, these plants were used.	[73]
4	The Yucatec Maya used the leaves and flowers in hot baths to treat night sweets.	[73]
5	The Kalinchok region, to the north of Kathmandu, occasionally uses the plant to make liquor.	[73]
6	In traditional medicine, the leaves of these plants are used for their pharmacological significance.	[72]
7	This flower could be used as gajra, or flower garlands in wedding rituals at Tamil Naru and many other states of India.	
8	Used as worship for many religious purposes.	
9	The identification and isolation of the propyl gallate compound from the plant extract using traditional methods suggest its potential application in various industries, such as food preservation	[46]
10	The presence of alkaloids, flavonoids, saponins, and tannins in good quantities in all parts of the plant, especially the leaves, suggests their potential use in the development of new medicinal and industrial substances	[74]
Sl. No.	**Herbal uses**	**Reference**
1	In addition to its antioxidant and anti-hyperlipidemic properties, the plant relies on antibacterial, antifungal, anticonvulsant, anti-HIV and larvicidal activities.	[78]
2	This herb has medicinal significance in Chinese folk medicine and is used to treat burns and swelling.	[79]
3	A significant hair tonic, hepatoprotective, antileishmanial, antiviral, antifungal, antipyretic and antihistaminic activity has been reported.	[80]
4	Secondary metabolites make up the majority of the aromatic compounds that this plant produces.	[81]
5	Terpenoids (odor-causing molecules) can play a role in pigmentation (tannins and flavonoids), as well as flavones (tannins and flavonoids) in this plant	[81]
6	For primary health care, approximately 75-80% of the population (developing countries) still use herbal medication from this plant because of its cultural acceptability, compatibility and side effects.	[82]
7	Certain communities, ethnic groups, and tribes have used this plant in medicinal practice, such as teas, syrups, and tinctures, among others, for healing purposes.	[82]

6. CONCLUSIONS

The fragrant night-blooming jasmine plant has a wide range of therapeutic uses including wound healing, hepatoprotective, antipyretic, antioxidant, antibacterial, antifungal, anticancer, hypoglycemic, antimalarial and antiepileptic effects. Because of its stunning and fragrant white flowers, night-blooming jasmine is also used as an ornamental plant. Chinese traditional medicine applies the leaves of *C. nocturnum* externally to treat swellings and burns. To confirm the effects listed above in humans, more investigation and clinical testing are required. Methods such as screening and phytochemical profiling of these plants aid in the identification of elite species. Correct identification of herbal drugs in commerce aids in the prevention of drug piracy and as a result, makes genuine botanicals available to consumers and drug manufacturers for their proper use as medicine. The precise amount required to make a more efficient source of medicine for its use in the best way is determined by this process. Alkaloids, sugars, glycosides, saponins, proteins, amino acids, phenolic compounds or tannin content, the extract yields the same result. Additional research can be conducted to evaluate the pharmacological activities and potential applications of the isolated compound, propyl gallate, in various fields such as medicine, agriculture and cosmetics. Comparative studies can be carried out to assess the phytochemical composition and biological activities of *Cestrum nocturnum* from different geographical locations to determine any variations in its chemical profile. Additionally, the dosage, preparation methods and potential side effects of any herbal remedy should be carefully considered.

DATA AVAILABILITY

The research data is available on request.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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