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Cascabela thevetia Ethnobotanical, Phytochemistry, Pharmacological Activities and Medicinal Uses: A Detailed Study

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ABSTRACT

There are a few different names for the member of the Apocynaceae family known as *Cascabela thevetia*. Some of these names include digoxin, lucky nut, and yellow oleander. The lovely and evergreen *Cascabela thevetia* is a dicotyledonous shrub that is known for its evergreen nature. There are a number of countries in Central and South America, as well as a number of Asian nations, where the *Cascabela thevetia* plant is indigenous. These countries include India and Sri Lanka. The *Cascabela thevetia* plant has been found to have a wide variety of secondary metabolites, such as alkaloids, flavonoids, steroids, terpenoids, tannins, saponins, and cardiac glycosides. These plants include a number of cardiac glycosides, including neriifolin, thevetin A, thevetin B, and oleandrin, and each and every one of them is dangerous. The leaves of the plant are used in traditional medicine not just for their alleged medicinal benefits, but also for their diuretic and cardiotonic effects. The pharmacological activity of a number of plant components, including seeds, flowers, bark, fruits, and leaves, has been reported in a number of different experiments. It is common for *T. peruviana* to be the cause of toxicological emergencies in tropical and subtropical climates all over the world. Numerous cardiac glycosides, including neriifolin, oleandrin, thevetin A, and thevetin B, are discovered in this potentially hazardous plant. These glycosides are only a few examples. After consuming oleander, some of the symptoms that may manifest themselves include hyperkalaemia, nausea, vomiting, diarrhoea, and abdominal pain. Oliander can also cause diarrhoea. The purpose of this review is to provide a comprehensive data collection that includes information on morphology, cultivation and propagation, distribution, phytochemistry, traditional uses, and pharmacological qualities.

Keywords- *Cascabela thevetia*, ethnobotanical, phytochemistry, pharmacological activities.

I. INTRODUCTION

Approximately eighty percent of the world's population relies primarily on traditional medicines for their primary healthcare, which highlights the continuous crucial necessity of traditional medicine systems that are based on plants. From the beginning of human history till the present day, "Mother Nature" has been the most reliable source for the discovery of new medicines (Shrikumar & Ravi, 2007). Indian medicinal plants are

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utilised for a wide range of reasons by people all over the world (Owolabi et al., 2007). These applications include traditional medicine, alternative medicine, and pharmaceuticals. Traditional medical practices continue to make substantial use of medicinal plants and the derivatives of those plants in the treatment of a wide range of ailments, including cancer (Jana & Shekhawat, 2010). Natural medications derived from plants have a limited number of adverse effects, if any at all, are easily accessible, and are not only efficacious but also affordable and controllable. They are not only useful to the pharmaceutical business because they are a raw material, but they may also be utilised as a phytomedicine to treat a wide variety of medical ailments. This makes them an extremely valuable resource (Ahmad & Rajagopal, 2013).

Cascabela thevetia, also known as yellow oleander in English and Peeli Kaner in Hindi. This plant can be found all around the country. In addition to *Cascabela thevetia* and other little decorative plants, the Apocynaceae family also includes additional plants (Rajhans et al., 2019). The brilliant yellow blossoms that this plant yields are the source of its other names, which include pillikaner in Hindi and yellow oleander in English. Both of these names originate from the fact that the plant is native to India. Also known as milk bush, Kaner, fortunate nut, and yellow oleander, this plant is also known by similar names. Originally, this evergreen tree can be found growing in the forests of the tropics and subtropics. This plant is most frequently used as an ornamental in gardens and along roadside dividers. It is also commonly used in other decorative applications. In addition to being able to easily resist hostile settings, it does not require any maintenance. It requires a very small amount of water while it is in the growing stage. It blossomed over a period of one and a half years. When planted as hedges, they have the ability to produce between 400 and 800 fruits annually; however, this number change depending on the amount of rainfall and the age of the plant (Basumatary et al., 2020). As the fruits grow, their colour shifts from green to black, and they are often spherical and green in appearance. Each year, there is a blooming cycle. For every kilogramme of dry kernel, approximately half a litre of oil can be extracted from the fruit, which contains two or four seeds that are grey and flat. It grows to a height of around 10 to 18 feet, and its leaves are linear and spirally organised. The length of its leaves ranges from 13 to 15 centimetres (Balandrin et al., 2006).

It is believed that Andre Thevt, a French missionary who was responsible for collecting species in South America, was the one who gave the plant the scientific name "thevetia" around the year 1502. Both the fluid and the seeds of a yellow oleander are poisonous. In the seeds, there is a substance that stimulates the heart. The oil it produces is extremely valuable to the Chinese industrial sector, and the fact that it can endure hard settings makes it an excellent option for the rehabilitation of damaged soil (Seetharaman et al., 2017). Nevertheless, according to Atteh (1995), the protein content of thevetia cake is 48% once the fat extraction process has been completed. Based on the data, it appears that it poses a risk to broilers and that it needs to undergo additional processing before it can be utilised in animal feed in an efficient manner (Atteh et al., 1995). Both the yellow oleander, also known as the common oleander, and the *T. peruviana*, also known as the Nerium oleander, are examples of plant species that are able to flourish in temperate zones all over the world (Oderinde & Oladimeji, 1990). Digoxin is a medication that is used to treat heart conditions, and the "cardiac glycosides" that are found in both species are the same (Yadav et al., 2010). According to a number of accounts, both species are poisonous when consumed orally and have the ability to result in the death of their human counterparts. In addition to this, it is possible that this plant is capable of producing cardiac glycosides that have a higher therapeutic index than digoxin. Some examples of these glycosides include neriifolin and peruvoside. In addition, a great number of African countries do not have sufficient information regarding the antifungal activity of yellow oleander and the plant-protective qualities of the plant.

Alkaloids, glycosides, saponins, flavonoids, tannins, fixed oils and fats, and phenolic compounds are some of the other phytoconstituents that have been found in yellow oleander 6 (Soni et al.). Some of the human disorders that can be alleviated by the plant or its components include diabetes, liver damage, fungal infection, microbial infection, inflammation, fever, and discomfort (Dixit et al., 2015). These are only some of the conditions that occur in humans. This plant is said to have a wide range of potential applications in the medical field, including the treatment of HIV, inflammation, spermatogenic bugs, termites, fungi, antioxidants, bacteria, diarrhoea, and cancer, among other conditions (Bhoyar, 2021).

1.1 Taxonomical classification

Kingdom: Plantae
Subkingdom: Tracheobionta
Super division: Spermatophyta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Asteridae
Order: Gentianales
Family: Apocynaceae
Genus: Thevetia
Species: peruviana

II. DISTRIBUTION

It is typical for plants of this species to be found in tropical and subtropical climates. These plants can also be found in countries located in Central and South America, as well as in various Asian countries, including India and Sri Lanka. The foliage of this small tree is green, and it has trumpet-shaped flowers that are either yellow or orange-yellow in colour (Chate et al., 2016). It is rather

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attractive. Flowers do not generate an odour, and fruits can have a dark green or black look. Flowers do not have an odour. There is a milky sap component known as thevetin that can be found in fruits that are relatively large in size. It is possible for thevetin, which is a glycoside, to provide stimulation to the heart. On the other hand, the material is poisonous. For the purpose of assisting the plant in retaining more water, the leaves have a waxy covering on them. The stems of an old plant will change colour from green to grey as the plant ages.

2.1 Morphology

- **Height:** *Cascabela thevetia* is a type of evergreen shrub or small tree that normally reaches a height of three to eight meters and has a crown that is densely branched.
- **Leaves:** The length of the leaves ranges from 13 to 15 centimetres, and they are dark green in colour. They are simple, alternate, and venationed in a reticulate pattern. The arrangement of them is in the shape of a spiral.
- **Flowers:** Grow in dense clusters on top of twigs; their petals are funnel-shaped and spirally twisted; they have five lobes, and their hue is a dazzling yellow.
- **Fruits:** Approximately four to five centimetres in diameter, the fruits are slightly fleshy, and they have a shape that is somewhat spherical. There is a period of time when they are green, but as they mature, they turn black. Each fruit contains a nut, and the nut is divided in two directions: lengthwise and across. The milky fluid is present in every component of the plant.
- **Stem:** Initially green, the stem matures to a silvery grey.
- **Seeds:** There are four seeds that are endospermic that are contained.
- **Habitat:** Dry regions, open woodlands, pastures, streams, gardens, and spots along roadsides are examples of places where there is a high risk of drought occurring.

III. CULTIVATION AND PROPAGATION

- **Cultivation:** *T. peruviana* is grown for aesthetic purposes in gardens and parks in temperate regions. It can be grown as a large blooming shrub or as a tiny decorative tree. You can use this potted plant as a houseplant or put it inside your nursery for the winter if you live in an area that suffers freeze-thaw cycles. Both of these options are available to customers. It will live regardless of the type of soil it is in. This plant thrives in environments that are warm and have reflected or partial sunlight. The abundance of water is wonderful. Although it is possible to cultivate this plant as a shrub or tree outside in warmer climates, it is recommended that you bring it inside for the winter months in locations that are prone to frostbite. Only occasional trimming or trash clearance is required, and it takes only a little amount of upkeep. The garden soil must be improved and have great drainage. There is no requirement to train young trees (Singh et al., 2012).
- **Propagation:** It is recommended that their coats be washed for two or three minutes in a solution consisting of 10% bleach and 90% hot water throughout the springtime before planting seeds. The seeds should then be submerged in hot water for a period of at least twenty-four hours. In addition, it is feasible to cultivate it from hardwood cuttings in the spring or early summer before the season begins.
- **Chemical Constituents**: The *Cascabela thevetia* plant has been found to have a wide variety of secondary metabolites, such as alkaloids, flavonoids, steroids, terpenoids, tannins, saponins, and cardiac glycosides. In this section, we shall discuss the phytoconstituents that have been isolated from the various parts of the *Cascabela thevetia* plant (Figure 2):
- **Leaves:** In addition to a cardenolide, cardiac glycosides, sterols, iridoid glucosides, and pentacyclic triterpenes were extracted from the leaves of the medicinal plant. A number of compounds, including neolupenyl acetate, lupeol acetate, oleanolic acid, ursolic acid, stigmast-5-en-7-one, and β-sitosterol, are capable of being discovered in leaves that are fresh and have not been crushed. Both kaempferol and quercetin are examples of flavonol glycosides that have been isolated from the leaves. Apiosyl glucosides and polyhydroxy-dino monoterpenoids are also present in the leaves of the plant (Essiett & Udolfa, 2014).
- **Bark:** Neriifolin, thevefolin, peruvoside, and (20S) -18, 20-epoxy digitoxigenin α-L-thevetoside are the four cardenolide glycosides that are found in the bark extract (Bawazeer, 2021).
- **Root:** In addition to iridoids, theveside, and theviridoside, Chinese researchers made the discovery of two novel glucosides, namely 10-O-β-D-Glucopyranosyl theviridoside and 3-O-β-D-Glucopyranosyl theviridoside. These glucosides were detected in the root extract (Altıner, 1999).

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- **Fruit Pericarp and Flowers:** Some of the components include quercetin, eugenol, kaempferol, hesperetin-7-glucoside, and epiperuviol acetate. Furthermore, the blooms contained β-amyrin and Quercetin-7-o galactoside, in addition to the presence of 14, 17, and 18. The seed kernels contain a significant amount of cardioactive glycosides, which are often commonly referred to as triosides due to the fact that their aglycones contain three sugar units (Essiett & Udolfa, 2014). The composition contains a significant amount of the glycoside known as thevetin. The substance that is referred to as thevetin is composed of two triosides, namely Thevetin A and Thevetin B, also known as cereberoside (Shriyan et al., 2011).
- **Seed:** There are a number of monoside chemicals that can be found in the seed kernel. These compounds include neriifolin, acetyl neriifolin, thevefolin, theveneriin, and peruvoside. More than sixty-two percent of the seed kernel is composed of fatty oils. Additionally, the seed contains minute quantities of the substance known as theveside, viridoside, and perusitin. Additionally, apigenin-5 methyl ether was obtained from seed shells (Oji et al., 1993).

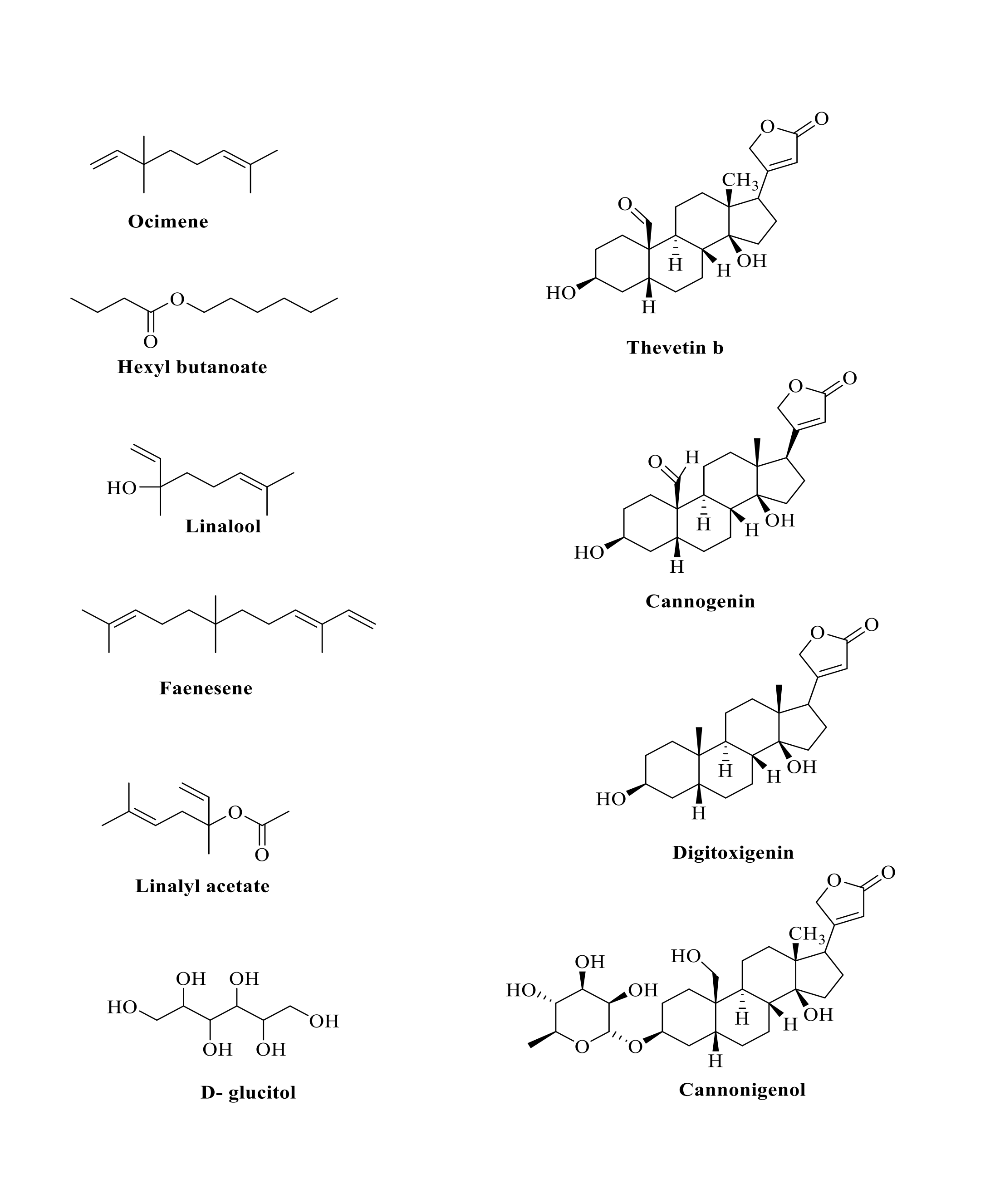

Fig 2: Some chemical constituents of *Cascabela thevetia*

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3.1 Toxicity

The entire *C. thevetia* plant is toxic to the vast majority of vertebrates due to the presence of cardiac glycosides incorporated into its composition. There have been multiple stories of people being poisoned, either intentionally or accidentally. These poisonings have occurred.

Some of the most frequent types of toxins are thevetoxin, ruvoside, peruvoside, neriifolin, and the cardenolides thevetin A and thevetin B (Rajapakse, 2009). These cardenolides are resistant to drying and heating, just as digoxin, which takes its name from the Digitalis purpurea plant. They contribute to the development of negative effects on the heart and stomach. Additionally, immunological fabs (antibodies) to digoxin and atropine are also potential therapeutic options (Roberts et al., 2006). Oral administration of activated charcoal is one of the potential treatment options. Despite the fact that there is a treatment for *T. peruviana* poisoning that makes use of an ovine polyclonal anti-digitoxin Fab fragment antibody (DigiTAb; Therapeutic Antibodies Inc.), the cost of this treatment is prohibitively expensive for many nations. On the other hand, there are some birds that are able to consume them without experiencing any adverse effects (Bandara et al., 2010). The sunbird, the Asian koel, the red-vented bulbul, the white-browed bulbul, the brahminymyna, the commonmyna, and the common grey hornbill are some examples of the species that fall into this description. People in rural areas of Sri Lanka and southern India are known to end their own lives by ingesting the seeds of a plant that is referred to as *Thevetia peruviana* (Sinhala) or Manjalarali (Tamil) (Eddleston & Warrell, 1999).

3.2 Traditional uses

There is evidence that medicinal plants, usually referred to as medicinal herbs, have been utilised in traditional medicine from prehistoric times. Some of the various dangers that plants face include herbivorous mammals, fungus, insects, and diseases. In order to protect themselves from these dangers, plants produce hundreds of different chemical compounds. Additionally, *Cascabela thevetia* has been utilised for a significant amount of time as a herbal cure (Rajhans et al., 2023). The bark of the *Cascabela thevetia* tree has been traditionally used for a variety of purposes, including the treatment of amenorrhoea, intermittent fever, ulcers, purgative, febrifuge, and snake bites. In addition to alleviating jaundice, fever, intestinal worms, severe headaches, and common colds, the leaves have a wide range of clinical applications in the field of medicine. In addition to being an emetic, an abortifacient, a cure for rheumatism, a skin disease, and a haemorrhoid, the seeds can also be used to treat peptic ulcers.

Table 1: Traditional uses of various parts of *Cascabela thevetia*

Plant part	Traditional use
Leaves	Emetic and purgative, jaundice, fever, eye drops and nose drops to cure colds, violent headaches. Flavonol glycoside from leaves has an inhibitory effect against HIV-1 Reverse Transcriptase and HIV1 Integrase.
Roots	Snakebites, roots are made into plaster and applied to tumors.
Seeds	Seeds are poisonous, abortifacient, and alterative. Emetic, haemorrhoids, skin problems, laxative, used as purgative in dropsy and rheumatism
Fruits	Ointments and liniments
Bark	Malarial fever, snake bites, purgative, emetic, sores, amenorrhoea, cathartic, febrifuge, useful in different kinds of intermittent fevers.

IV. PHARMACOLOGICAL ACTIVITIES OF THIS PLANT

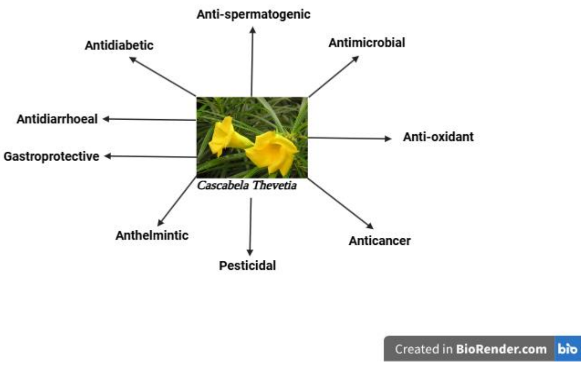

Fig. 3: Pharmacological Activities of different part of *Cascabela thevetia*.

4.1 Antimicrobial activity:

Sowjanya *et al.* studied the antibacterial characteristics of many different solvent extracts of *Cascabela thevetia*. They used the agar well diffusion method to conduct their research. The leaf extracts that were extracted using methanol and chloroform demonstrated the highest levels of activity when compared to the other extracts. When it came to eliminating the bacteria *Staphylococcus aureus*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, and *Candida albicans* (a fungal pathogen), the leaf extracts that were extracted with methanol were the most successful (Sowjanya et al., 2013). It was revealed that the chloroform extract had the highest level of efficiency against *E. coli* and *Pseudomonas aeruginosa*. It was found that extracts in ethyl acetate and hexane had some degree of effectiveness against the bacteria that were indicated. An organic solvent extract of *Cascabela*

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thevetia leaves that contained 95% alcohol was shown to have antibacterial activity against 10 pathogenic microorganisms that are of high medical relevance, according to an investigation that was carried out by Reddy and colleagues. The extract was effective against *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Escherichia coli*, but it was only effective against *Proteus vulgaris* when it was administered in higher dosages. Species of *Staphylococcus aureus*, *Candida albicans*, *Aspergillus niger*, Mucor, Rhizopus, and Penicillium were all inhibited to a moderate degree by the antibacterial activities of the extract (Reddy, 2010). According to the findings of the research carried out by Nesyet al., seed kernel extracts were demonstrated to possess antibacterial properties when tested against human skin pathogenic microorganisms. When compared to chloroform and methanol fractions, the antibacterial activity of ethyl acetate was shown to be significantly higher for strains of *Pseudomonas aeruginosa*, *Nocardia asteroids*, and *Candida albicans*. On the other hand, when it comes to *Candida albicans*, lesser quantities of chloroform fractions exhibited a higher level of sensitivity (EA & MATHEW, 2016).

4.2 Antioxidant activity

During the process of comparing the methanol whole plant extract of C. thevetia to other extracts, Seetharaman and colleagues discovered that it displayed 50% inhibition (IC50) at a concentration of 60.1µg/µl when it was used on its own. In comparison to other extracts, the results demonstrate that *C. thevetia* possesses a more potent antioxidant action in the context of DPPH radical activities." In order to investigate antioxidant activity, the DPPH test has seen broad application. This is due to the fact that it is able to handle a large number of samples in a short amount of time and is sensitive enough to identify active components at low concentrations. The DPPH radicals would be scavenged by a proton-donating molecule, such as an antioxidant, which would also diminish the radicals' ability to absorb. The DPPH free radical scavenging assay was utilised in order to assess the antioxidant properties of three different morph forms of *Cascabela thevetia*, Juss fruit wall extracts. This was done in accordance with the findings of Nesy et al. Methanol, ethyl acetate, chloroform, and petroleum ether were some of the organic solvents that were utilised in this experimentative process. At a concentration of 1.2 mg/ml, the fraction of ethyl acetate demonstrated a rate of inhibition of DPPH free radical scavenging activity that was fifty percent significant (Seetharaman et al., 2017).

In their research, Mozibullahe et al., demonstrated that extracts of the leaves of *Cascabela thevetia* performed exceptionally well in terms of DPPH scavenging activity. The IC50 value, which is the concentration at which half of the radicals are neutralised, can be determined by plotting the concentration of extracts against the proportion of free radicals that they scavenge (Asong et al., 2019). This allows one to determine the IC50 value. In comparison to gallic acid, which serves as a positive control or standard, leaf extracts have been found to have a lower IC_{50} value, according to one piece of research. When compared to ethanolic extracts, which had an IC_{50} value of 313 µg/ml, and methanolic extracts, which had a value of 315.6 µg/ml, respectively, combined methanolic leaf extracts from *Cascabela thevetia* revealed considerable synergistic effects on DPPH radicals. However, the IC50 value for the combined extracts was 29.64 µg/ml (Mozibullah et al., 2023).

4.3 Antifungal Activity

Asare et al. investigated into the photoactivities of *Cascabela thevetia* seedlings directed against fungus. Additional analysis was performed with thin-layer chromatography, and column chromatography was utilised for the separation of decoctions that were prepared with dichloromethane or n-hexane. For the purpose of examining the photoactive inhibitory qualities, the seed and fractional extracts were examined to determine whether or not they had the capacity to inhibit the growth of Cladosporium cucumerinum. A light-dependent antifungal impact was observed in a number of fractions as well as in both extracts (Asare et al., 2015). Either column chromatography for fractionation or thin-layer chromatography for further analysis was performed on the extracts, regardless of whether or not they had been produced with dichloromethane. We put all of the seed fractions and extracts through a series of tests against the fungus Cladosporium cucumerinum in order to evaluate the photoactive inhibitory effects. An antifungal activity that was reliant on light was observed in crude extracts as well as in a portion of the fractions. An examination of the photoactive fraction and the identification of its constituents were carried out with the assistance of capillary gas chromatography with mass spectrometry. Given that pulsegone is a significant component of the terpene fraction, it would appear that the reported phototoxicity against the fungus that was tested is at least partially attributable to pulsegone (Gata-Gonçalves et al., 2003).

4.4 Anticancer activity

In their research, GJ and colleagues demonstrated that the bark of the anti-cancer medicinal plant *Cascabela thevetia* contained fifteen trace elements that are necessary for human metabolism. In addition to this, they utilised the PIXE method in order to investigate the differences in the concentrations of these elements that were found in samples acquired from four different locations. In accordance with the findings of our investigation, the anti-cancer action of the plant can be better comprehended by examining the elemental composition of the plant. It is possible to compare the concentrations of elements that have been extracted from various regions of the world in order to determine how changes in the environment have impacted this plant (Ramos-Silva et al., 2017). As a result of the fact that ayurvedic practitioners rely on their substantial

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knowledge when prescribing dosages of herbal formulations including *Cascabela thevetia*, it is essential that these dosages be supported by scientific data. There is no cause for concern regarding element toxicity when 900 mg of bark powder is consumed on a daily basis. This is due to the fact that the concentration of the elements is within the range of the recommended daily allowance (RDA) or the daily reference intake (DRI) for all of the elements that have been detected. These herbal plant supplements, when paired with a healthy diet, have the potential to assist in the restoration of important nutrients. Physicians should be able to use the findings of this study to assist them in determining how long and how much of this herbal medication to administer to cancer patients. According to Ramos-Silva et al., the methanol extract of *Cascabela thevetia* fruit inhibits the proliferation of cells, induces apoptosis, and has time-dependent cytotoxic activity against human cancer cell lines. On the other hand, normal cells show very little to no effect. The anticancer effects of the fruit extract were primarily mediated through three different pathways: molecule permeability, DNA fragmentation, and motility. Cytotoxic effects were most pronounced in the proportion of the sample that contained the greatest number of cardiac glycosides and a single flavonoid. Chemical experiments are currently being conducted on the active fractions in order to have a better understanding of the biological consequences of these fractions. The extract of the fruit of *Cascabela thevetia* shows a great deal of promise as a cancer treatment; nevertheless, additional "in vivo" research are required to demonstrate its efficacy (GJ & P, 2024).

4.5 Antidiabetic Activity

According to research conducted by Gogoiet al., the bark extract of *Cascabela thevetia* L. was able to normalise serum biochemical profile, including fat content, and lower blood glucose levels in rats when compared to animals that served as negative controls. Compounds belonging to this family have showed antidiabetic, hypoglycemic, and antihyperglycemic activities. Many phyto-constituents, such as alkaloids, flavonoids, triterpenoids, and tannins, were found in the bark of *Cascabela thevetia* L. There is a possibility that these phyto-constituents are responsible for this action. Further isolating the substance or compounds allows us to get knowledge about the action mechanism at the molecular level and to determine the chemical component that is responsible for the behaviour. The results of the study demonstrated that the bark of *Cascabela thevetia* L. possesses the antidiabetic potential that was hypothesised; nevertheless, additional research, including examinations at the molecular and clinical levels, is required to validate the relevance of the plant as an effective medicinal ingredient (Gogoi & Bhuyan, 2017).

4.6 Anti-spermatogenic Activity

Research conducted by Adhikari et al. utilised phytochemical studies to study the potential antifertility effects of *Cascabela thevtia*, which is more often referred to as *Thevetia peruviana*. The research was conducted on male albino rats. Upon conducting research on the phytochemistry of the plant, it was discovered that it possesses a multitude of active compounds, including α-amyrin acetate, lupeol acetate, α-amyrin, β-amyrin, lupeol, and thevetigenin. In male rats that were given an oral dose of 100 mg/rat/day of methanol extract from the stem bark of *Cascabela thevtia*, there was a statistically significant reduction in the weight of the reproductive organs. However, there was no discernible effect on the overall body weight of the rats. The amount of glycogen found in the testes decreased significantly, and there was an increase in cholesterol levels. On the other hand, there was a significant increase in the amount of total protein and sialic acid found in the epididymides, seminal vesicle, and ventral prostate from the previous study. In addition, the methanol extract of the stem bark of *Cascabela thevetia* was shown to have a reduction in the number of spermatogenic elements. These elements included preleptotene and pachytene spermatocytes, secondary spermatocytes, round spermatids, and mature Leydig cells. At this dosage, there was a significant reduction in the following parameters: the diameter of the Leydig cell nuclear diameter, the diameter of the seminiferous tubules, and the quantity of sertoli (Adhikari et al., 2023).

4.7 Anthelmintic activity

For the purpose of determining whether or not yellow oleander bark extract possesses anthelmintic properties, Rajhans and colleagues measured the amount of time it took for earthworms (Pheretimaposthuma) to become paralysed and eventually die. The higher dose of extract resulted in a significantly earlier paralytic effect and a shorter time to death than the lower dose. The anthelmintic action of the methanolic extract of *Cascabela thevetia* was shown to be dose-dependent after administration. In the aqueous extract, the paralysis and death time of worms were measured to be 42.67±0.72 minutes and 57.67±0.72 minutes, respectively, at a higher concentration of 50 mg/ml. This was in contrast to the results obtained with albendazole, particularly at a lower concentration of 20 mg/ml, where the respective values were 17.67±0.54 minutes and 48±0.47 minutes. A methanolic extract of the bark of *Cascabela thevetia*, which has been traditionally used by indigenous people to treat worm infections in the intestines, had a moderate amount of anthelmintic activity after being tested (Rajhans et al., 2023).

4.8 Antidiarrhoeal Activity

There was a significant reduction in the amount of diarrhoea that albino rats experienced when they were administered an ethanol extract of yellow oleander leaves rather than castor oil, as demonstrated by Hassanet et al. Castor oil-induced diarrhoea in albino rats generated a reaction from the control group, 66.7% of the ethanol extract treatment group, and 75% of the loperamide (positive control) group. The control group was the only group involved in the experiment. The groups that were treated with ethanol extract (2.4 ± 1.66 respectively) and

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the positive control (1.8 ± 1.11 respectively) saw a significant reduction in the occurrence of diarrhoea ($p<0.01$) as compared to the control group (Hassan et al., 2011).

4.9 Pesticidal activity

In their study, Srijaet al. discovered that the methanolic leaf extracts of three different plant species *C. papaya*, *C. thevetia*, and *C. bonduc* contained a wide range of phytochemicals. The extract made with methanol contained the greatest quantity of phytochemicals overall. The larvicidal bioassay demonstrated that the methanolic extracts of the leaves of the *C. bonduc*, *C. papaya*, and *C. thevetia* plants were effective against Ae. vittatus larvae. The methanolic extract of the *C. thevetia* leaves shown the highest level of activity among the three extracts (Srija et al., 2023). The other two extracts also displayed significant larvicidal activity, which was confirmed by the results. Although the LC50 and LC90 values were somewhat higher for the other two extracts, the values for the *C. thevetia* leaf extracts were the lowest of the three. An aqueous extract of the leaves of *C. thevetia* was used to treat adults of the Holotrichia Serrata (Fab.) parasite, as evidenced by the findings of Balderas-López et al. The aqueous leaf extract that was investigated was able to successfully cause fifty percent mortality of Holotrichia serrata (Fab.) following a bioassay that lasted for forty-eight hours, with a toxicity level of 0.025 percent. Following the following sequence of toxicity: ethyl acetate> acetone> methanol> petroleum spirit, the leaf extract of *C. thevetia* displayed an insecticidal effect against three strains of T. castaneum (CR1, CTC12, and FSS2) (Balderas-López et al., 2019).

4.10 Gastroprotective Activity

In a manner that was sensitive to naloxone, the acetic acid-writhing response was found to be significantly reduced by the volatile oil of *C. thevetia*, as stated by Kumar et al. In the hot plate test, the analgesic activity that was observed after oil inhalation was prevented by pre-treatment with naloxone and atropine sulphate. This suggests that both cholinergic and opioidergic pathways were engaged in the process. Regardless of the method of administration or the experimental paradigm, neither linalool nor 1,8 cineole exhibited any demonstrable analgesic effects. Neither of these substances was able to alleviate pain. There was no discernible impact on the spontaneous locomotor activity of mice under the influence of volatile oil, regardless of whether it was inhaled orally or supplied orally. The oral administration of oleander oil, linalool, and 1,8 cineole provided protection against acute stomach ulcers caused by ethanol. On the other hand, indomethacin-induced lesions were not avoided, which suggests that the arachidonic acid metabolic cascade was not disrupted. Furthermore, in addition to its gastroprotective characteristics, oleander oil possesses an intriguing analgesic effect. This analgesic action is most obvious when the oil is inhaled, and it is present at levels that do not cause sedation. This raises the possibility that it may be utilised in aromatherapy therapies (Kumar et al., 2015).

4.11 Ethanomedicine, Nanotechnology and Biodiesel yielding activity

In order to produce silver nanoparticles (AgNPs), the following 10 plant extracts were utilised in the biosynthesis process: Caryotaurens makes up GNP1, Pongamia glabra makes up GNP2, Hamelia patens makes up GNP3, Thevetia peruviana makes up GNP4, Calendula officinalis makes up GNP5, Tectona grandis makes up GNP6, Ficus petiolaris makes up GNP7, Ficus busking makes up GNP8, Juniper communis makes up GNP9, and Bauhinia purpurea is the tenth herb. The testing of the AgNPs focused on investigating drug-resistant bacteria and the biofilms that are associated with them. Based on the findings of this investigation, it can be inferred that the interaction between AgNPs and microbial cells resulted in the lysis of cells and the destruction of DNA (Tufail et al., 2022). The inhibition of microbial biofilms was also demonstrated to be very effective by these green AgNPs. Within the setting of bacteria that are resistant to many drugs, the antibacterial and antibiofilm characteristics of silver nanoparticles (AgNPs) have been demonstrated (Gakuya et al., 2013). In most cases, the manufacture of biodiesel from biomass that is high in lipids results in a significant amount of by-products, such as seed cover and de-oiled cake. In this study, the entire potential of *Cascabela thevetia* seeds as a source of biofuel is investigated through the use of a combination of chemical and thermochemical conversion pathways (Rajamani et al., 2023). A revolutionary approach to fully converting lipid-rich bioresources into a variety of biofuels and charcoal has been uncovered by the new research that has been conducted. An ethnobotanical investigation was conducted in the Meru central district of Kenya to investigate traditional biopesticides and other treatments involving plants. The purpose of this study was to conduct a survey and provide a description of the plants that are utilised by traditional healers in the Meru-central area (Tiwari et al., 2023). The study's primary focus was on plants that are used as biopesticides. The areas where the research was conducted were the Igane and Gatuune sub-locations, which are located in the Abothuguchi East division of the Meru-Central district in Kenya (Bebawi et al., 2014). Information was gathered from twenty-three traditional healers through the use of a variety of methods, including semi-structured questionnaires, focus groups, and transect walks. The herbarium located inside the Department of Land Resource Management and Agriculture Technology at the University of Nairobi served as the location where plant samples were collected and identified. According to the findings of the ethnobotanical survey, among herbalists, men made up the majority of the total (82.6%), while women made up 17.4% of the total. As a result of the fact that the central region of Meru is home to a wide variety of medicinal plants and biopesticides, greater research is required to investigate these plants and their potential

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pharmacological applications for the treatment of illnesses and the management of pests. Areas of *Cascabela thevetia* and the ethnobotanical applications of those areas Medicinal (the milky sap contains a chemical known as thevetin, which is employed for the purpose of promoting heart contractions, You can use it as a charm (for example, to cure a fallen fontanelle in children or to protect yourself from the "evil eye"). Haemorrhoids can be treated with a poultice that is created from the leaves; the bark and seeds are purgative; and the leaves and bark are, respectively, a treat for the heart and an antibacterial for the skin.

V. CONCLUSION

As a means of maintaining people's health on a worldwide scale, plants and herbal medicines that are produced from natural sources have recently come back into the spotlight as a potential solution. Individuals seek treatment for a variety of medical ailments by utilising the plant itself or particular components of the plant, such as its leaves, bark, seeds, or fruit. According to the information presented in this work, the plant has a wide variety of pharmacological activities and a large number of secondary metabolites, the most notable of which are glycosides. Despite the fact that there have been claims made about the medical benefits of *Cascabela thevetia*, there is a need for additional scientific research on the plant's potential for the treatment of different disorders. As of right now, the majority of individuals who are unwell are turning to herbal remedies, and the primary reason for this is that these treatments have fewer adverse effects than traditional pharmaceuticals. The *Cascabela thevetia* plant is a beautiful ornamental plant that possesses a great deal of pharmacological effect; yet, it has been proved to be harmless at various levels of inquiry. The action mechanism of *Thevetia peruviana*, along with its other beneficial effects, is not yet completely known. There is still a significant amount of work to be done. After a period of one and a half years, the plant starts to produce flowers, and it continues to bear fruits throughout the entire year, which guarantees a steady supply of seeds.

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