



INSIGHTS INTO PHYTO PHARMACEUTICAL STUDIES OF MANGROVE SPECIES VOLKAMERIA INERMIS: A REVIEW

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ABSTRACT

Chinese medicine and different Indian systems of therapies have employed therapeutically useful and ornamental vegetation for decades. Many of which have been discovered to have a wide range of medicinal properties that may be utilized for curing a multitude of terrible conditions. *Volkameria inermis* is a prime instance of a plant that fulfills both of these purposes. In the tropical and subtropical regions, a sprawling or scandent shoreline bushes known as *V.inermis* (Verbenaceae) grows in number. It was formerly known as *Clerodendrum inermis*. Early cultures employed the leaves, stems, flowers, fruits, and bark of *Volkameria inermis*, among other botanical components, for healthcare purposes. Research conducted on *V.inermis* demonstrates that it possesses chemical components such as tannins, alkaloids, glycosides, phenols, flavonoids triterpenoids, diterpenoids, volatile oils, and steroids. It additionally includes flavonoids Phenolic glycosides, chalcones, and phenyl ethanoid glycoside. It has an enormous variety of pharmacological characteristics, such as anti-inflammatory, analgesic, antipyretic, neurological and smooth muscle actions, antimicrobial, antidiabetic, antioxidant, antiparasitic, insecticidal, antiallergic, anticancer, protective, and numerous other pharmacological functions. Additional attributes include anti-tyrosinase, antifungal, and neuroprotective, hypotensive, hypoglycemia, and amyloid aggregation, wound healing, antipyretic, and larvicidal activity.

KEYWORDS: *Clerodendrum inermis*, Pharmacological Properties, Phytochemical Properties, Mangrove Plants, Anticancer, Anti Diabetic Activity.

BACKGROUND

A hardy shrub that may explode in a range of maladies is *Clerodendrum inermis*. They may be grown outside in the garden without protection during the warmer winter months. It may be beneficial to nurture the shrub in a container and bring it inside when the temperature descends below freezing in zones with harsher winters. Hydrating *Clerodendrum* frequently is essential, but only when the soil becomes totally dry. Apply mulch to hold on to moisture and treat the plant with a general-purpose fertilizer in the spring and summer. Tropical Asia is the genuine home of this plant. In addition, it is an evergreen mangrove plant that could turn into a weed in a coastal area by blossoming in proximity to the water during high tide.^[1-3]

1. INTRODUCTION

Biodiversity is a vital repository of novelty in regards to potentially useful molecules as well as a revolution in contemplating, a broadened perspective that promises to transform the indications of limiting research from previous years into portraits of the dynamic world of evolutionary biology, where organisms grow, have

differences, and begin to diverge from the norm^[4] A staggering range of secondary metabolites have been naturally produced over the years as nature's biodiversity evolved.^[5] Based on its empirical findings and tradition, mankind's foremost and, for a long time, only readily accessible medicines were made from plant extracts. The drug manufacturing industry acquired even more natural influence for medication research throughout the course of the twentieth century from endogenous substances, including prostaglandins, steroids, and peptide hormones, while natural products survived to be extremely crucial.^[6,7] In the survey of molecules found after 1970, a total of 1184 novel chemical entities (NCEs) got approval as pharmaceutical medicines.^[8] Since ancient times, medical conditions have been comforted and healed using compounds that are derived from animals, vegetation, and microbial organisms. Extracts from nature have been used as medications for almost 60,000 years. The extraction of resources from nature has brought about enormous difficulties and had a positive influence on the advancement of civilizations around the world since the beginning of time. Due to the rising expenses of medical treatment, these kinds of

extracts have been employed as an integral treatment for illnesses in regions that are developing alongside those in more prosperous ones. The vast majority of people use remedies from nature for preventative as well as curative purposes. Since around 80 years ago, approximately fifty percent of the chemical-based drugs that the FDA has given approval for have been influenced by and derived from substances that are natural.^[9] Manufacturers of health-related plant-based extracts and makers of aromatherapy oils are increasingly making use of the best methods of extraction as a consequence of the expanding worldwide market for plant-based goods for health care in general, nutritional supplements, and botanical medicines. For the generation of extracts and oils that are essential with the minimum alterations and of a specified effectiveness, numerous approaches are employed.^[10]

1.1 Plant introduction

Part of the Lamiaceae family, *Clerodendrum inerme* is semi-mangrove vegetation that is normally discovered



Fig. 1: *Clerodendrum inerme*.

1.2 Vernacular names^[13]

Table 1: Vernacular names.

Language	Name
Telugu	Etipisangi, Nellavuppi, Pishinika, Takkolapu-chettu
Hindi	Sankuppi
English	Garden quinine, Wild Jasmine
Urdu	Guldamdham
Tamil	Catpitakkani, Coraputpam
Sanskrit	Kundali
Marathi	Vanajai
Malayalam	Cheruchinna
Other	Smooth Volkameria

1.3 Botanical description

Botanical name: *Clerodendrum inerme*

Synonyms^[14]

- *Volkameria inermis*
- *Clerodendrum commersonii*
- *Volkameria commersonii*
- *Volkameria nereifolia*
- *Clerodendrum javanicum*
- *Clerodendrum nereifolium*

Common names^[15]

- Clerodendrum, Scrambling; Scrambling
- Clerodendrum;

flourishing on seaside shorelines. China authorized it as an effective therapeutic halophyte for numerous ailments, while Pakistan designated it as a hydro-halophyte advantageous for saline farming. Despite the fact that it's unclear how *C. inerme* embraces salt, it's an excellent salinity-tolerant plant to gain knowledge about its various scientific and practical uses in agriculture.^[11] As an ornamental plant or groundcover; *C. inerme* is widely used in horticulture. It contains appealing white flowers that grow in clusters and are further distinguished through elegant red projecting stamens on top of its exquisite evergreen leaves. As its name implies, seashore *Clerodendrum* flourishes well beside the coastline, resisting the sun's intense beams and the ocean's salty salt spray. This kind of plant is incredibly adjustable and is capable of being developed as a bonsai or as a shrubbery.^[12]

- Harmless Clerodendron; Clerodendron, Harmless.

Taxonomical classification^[15]

- Kingdom: Plantae
- Subkingdom: Tracheobionta.
- Superdivision: Spermatophyta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Subclass: Asteridae
- Order: Lamiales
- Family: Verbenaceae
- Genus: *Clerodendrum* L.
- Species: *Clerodendrum inerme*

Distribution

Local distribution

Madhya Pradesh, Odisha, Punjab, Sikkim, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Andhra Pradesh, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Madhya Pradesh, and the Andaman. Global Distribution: Oceanic Islands; Australasia; Pacific Islands; Asia: Bangladesh, Bhutan, Cambodia; China, India; Japan; Laos; Malaysia; Myanmar; Pakistan; Papua New Guinea; Philippines; Sri Lanka; Taiwan; Thailand.^[16]

Global distribution

Coastal India, Sri Lanka; currently naturalized along the coasts of Australia, China, and Myanmar.

Indian distribution

State: Kerala; Districts: Wayanad, Thrissur, Ernakulam, Alappuzha, Kasaragode, Kollam, Palakkad, Kannur, Thiruvananthapuram, Malappuram, Kozhikkode, Kottayam.^[17]

Karnataka: Chikmagalur, Hassan, Mysore, N. Kanara, S. Kanara Kerala: Alapuzha, Ernakulam, Kannur, Kasaragod, Kollam, Kottayam, Kozhikode, Malapuram, Palakkad, And Thiruvananthapuram

Tamil Nadu: All districts.^[18]

Morphology

A perpetually green shrubbery that is capable of reaching up to 3 meters tall and is widely used for fencing across gardens as well as additional areas.^[19]

A. Stem

It's frequently transformed into a pretty disorganized vine, but it also often produces both fruits and flowers as an herb that is around one to four meters tall. Vine branch thicknesses are estimated at up to 3 cm.

B. Leaves

Leaves, petioles, and twigs are smooth or moderately puberulous. Leaf blades possess a bottom surface that

can be glandular or punctuate, extending roughly 3–12 x 1-6 cm. The petioles have ridges or channels on the upper surface, extending around 0.5 and 1.5 cm in length. Inside the blade margins, lateral vasculature forms coils. Petioles possess a deep purple shade, while twigs are normally whitish in color.

C. Flowers

Puberulous pedicels, extending 3–6 mm. With tiny lobes and just a few enormously nectariferous ducts on its outermost layer and smooth on its interior, the end of the calyx is glandular, translucent, or puberulous, ranging approximately 3-6 mm in length. Corolla: glabrous and secretory on the exterior, cylindrical in shape, about 15–40 millimeters lengthy with lobes that are close to 3.5–11 mm lengthy, and slightly villous on the inner surface. Exserted stigmas, filaments ranging 15–38 mm in length, and anthers extending 2.5–3 mm in length. About 1.5 × 1-1.5 mm, glabrous and secretory ovary; typically 25-48 mm lengthy, translucent, exserted styles.

D. Fruits

Fruit is held in a receptacle analogous to the egg inside of an egg cup and has a structure made out of four outlets that fit together. An approximately 10-20 x 7-15 millimeter is the dimension of the fruit. Calyx remains at the bottom, leaving a cup-like structure with a circumference of 7–12 mm. According to the radicle's length, this ranges from 0.5–1 mm, the cotyledons measure roughly 5 mm long, respectively broader and longer

E. Seeds

Thick, fleshy cotyledons have dimensions of around 12–20 x 6–9 millimeters and shrink eventually into the petioles. The first foliage pair has opposite, completely or somewhat scalloped boundaries. The leaf blade is trapezoidal at the 10th leaf phase, with an outer edge that is intact or has a few teeth, a purple-colored stem that turns pale in color, and a terminal bud adorned with pale prostrate hairs. The midrib and petiole appear purple. Germination duration for seeds ranges between 22 and 28 days.^[20]



Fig. 2: *Clerodendrum inerme* a) Stem b) leaves c) Flowers d) Fruits e) Seeds.

2. Uses

2.1 Medicinal uses

- Clerodendrum inerme was historically utilized as a uterine stimulant and febrifuge, as a disinfectant, and as a pesticide for stopping profuse bleeding and to cure ringworm, breathing problems, liver disease, and discomfort in the stomach.
- Additionally, plants have been used for the management of scrofulous and venereal conditions, and they were also used to counteract fish, crab, and toad stool discomfort.^[21]
- The roots' extract made with methanol has analgesic and antibacterial benefits due to verbascoside.
- Topical rubbing of juice from the leaves was one way to cure problems with the skin.
- The roots are used for the treatment of rheumatic conditions shortly after they have been boiled in oils.
- The antimalarial characteristics of *C. inerme* were believed to be due to its close proximity to having a disagreeable flavor.
- It is commonly referred to as pechagnan and chankankuppi in the Siddha System of Medicine.^[22]

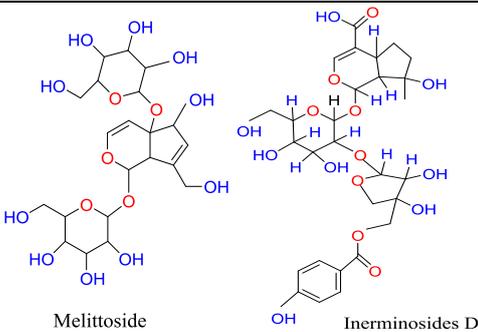
3. Phytochemical properties

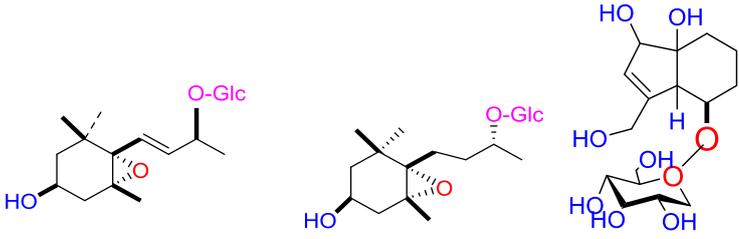
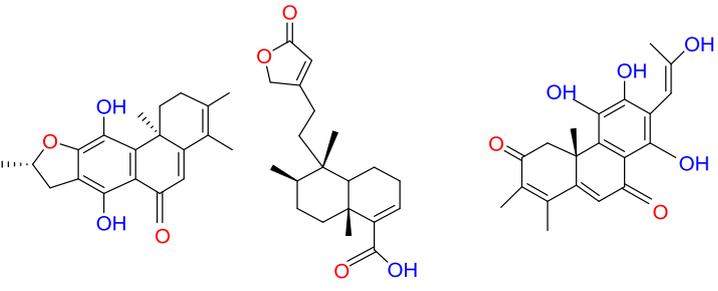
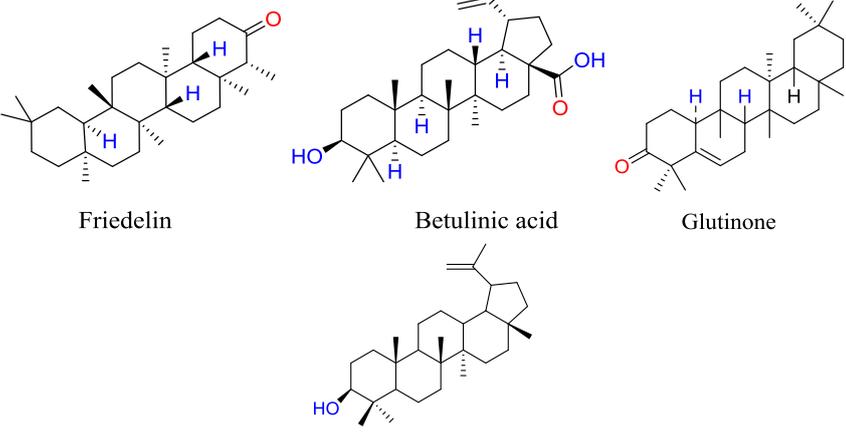
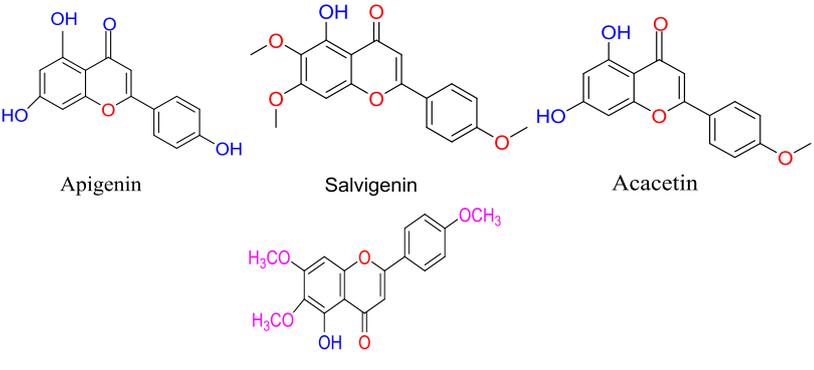
1. Compounds found in the leaves of *Clerodendrum inerme* that have not been previously reported from any *Clerodendrum* species are salvigenin (5-hydroxy-6,7,4'-trimethoxyflavone) and 5-hydroxy-7,4'-dimethoxyflavone. Clerodermic acid, a novel diterpene acid, was discovered during reexamination of *Clerodendrum inerme* leaves.^[23]
2. The leaves and stems of *Clerodendron inerme* L. were subjected to a phytochemical investigation, which led to the identification of five flavonoidal compounds: kaempferol, luteolin, luteolin-7-O-glucoside, apigenin, and one coumarin component called scopoletin. Chromatographic and spectral studies have been used to establish the structures of isolated substances.^[24]
3. Apigenin and scutellarein's 7-glucuronides were discovered through chemical analysis of an ethanolic

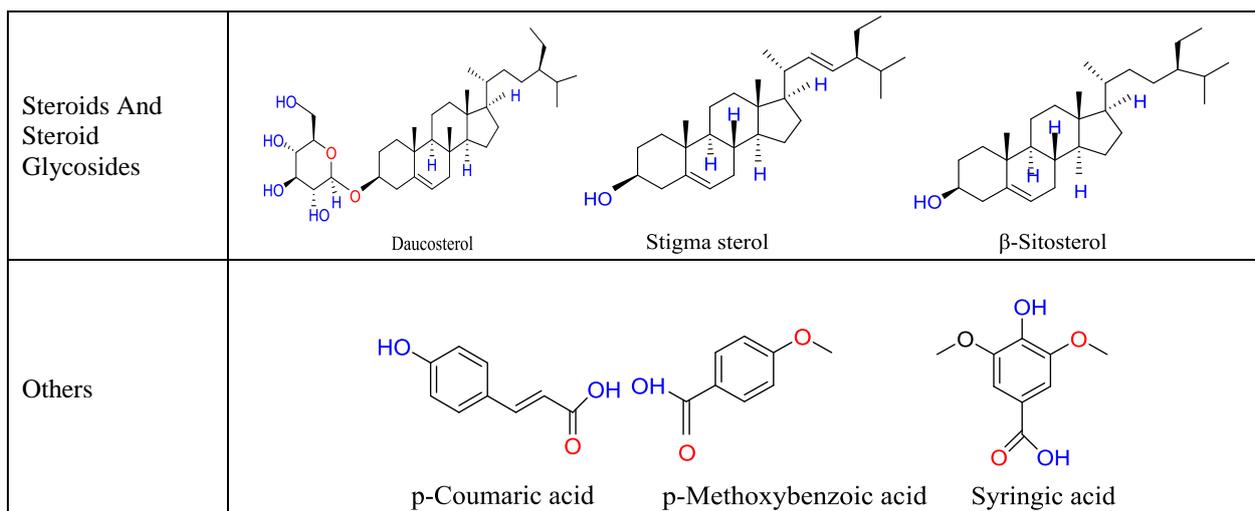
extract of *Clerodendrum inerme* leaves. The 4'-methyl ether and 6'-dimethyl ether of scutellarein, two 6-hydroxyflavones that are new to the family, were discovered in a continuous flavonoid survey of this family. Both compounds are found in the free state in the leaves of *Clerodendron inerme*.^[25]

4. Together with 15 known compounds, including phenylpropanoid glycosides, phenylethanoid glycosides, iridoid glucosides, neolignan glucosides, benzyl alcohol glycosides, aliphatic glucosides, and hydroquinone glycosides, the isolation and structural elucidation of two new megastigmane glucosides and one new iridoid glucoside have been identified.^[26]
5. From the leaves of *Clerodendrum inerme* (L.) Gaertn. (Verbenaceae), a novel triterpene glucoside, lup-1, 5, 20(29)-trien-3-O—D-glucopyranoside (4), has been isolated along with three recognised phytoconstituents: n-octacosane, friedelin, and amyirin. Chemical and physical evidence (IR, ¹H-NMR, ¹³C-NMR, DEPT, and MS spectra) were used to elucidate the structure. In analgesiometer experiments, the alcoholic and aqueous extracts of *C. inerme* leaves demonstrated a strong antinociceptive effect.^[27]
6. Using high-performance liquid and a number of spectroscopic assessments, the extracted compounds have been recognized as B-friedoolean-5-ene-3-β-ol, β-sitosterol, stigmasta-5, 22, 25-trien-3-β-ol, betulinic acid, and 5-hydroxy-6,7,4'-trimethoxyflavone. The DPPH experiment revealed scavenger action with regard to the total methanolic extract (TME) and 5-hydroxy-6, 7, 4'-trimethoxyflavone, with maximal inhibitions of 61.84% for TME (100 μg/mL) and 37.19% for 5 (20 μM), respectively. Furthermore, utilizing the formalin-induced hind paw edema technique, the TME showed stronger beneficial effects on inflammation than indomethacin at a concentration of 200 mg/kg.^[28]

Table 2: (Chemical structures of *clerodendrum inerme* compounds).

Compounds	Structures
Monoterpene	 <p>Melittoside</p> <p>Inerminosides D</p>

Sesquiterpenes	 <p style="text-align: center;">Sammangaoside A Sammangaoside B Iridoid glucoside</p>
Diterpenes	 <p style="text-align: center;">Uncinatone Clerodermic acid Cleroiermin</p>
Triterpenes	 <p style="text-align: center;">Friedelin Betulinic acid Glutinone</p> <p style="text-align: center;">Lupeol</p>
Flavonoids	 <p style="text-align: center;">Apigenin Salvigenin Acacetin</p> <p style="text-align: center;">5-hydroxy-6,7,4'-trimethoxyflavone</p>



[Chemical structures of Monoterpene- Melittoside,^[29] Sesquiterpenes -Sammangaoside-A, Sammangaoside-B,^[30] Irid glycoside,^[31] Diterpenes -Uncinatone,^[32] Clerodermic acid,^[33] Cleroinermin,^[34] Triterpenes-Friedelin^[35] Betulinic acid,^[36] Glutinine, Lupeol,^[32]

Flavonoids-Apigenin,^[35] Salvigenin,^[37] Acacetin,^[35] 5-hydroxy-6,7,4'-trimethoxyflavone,^[36] Steroids & Steroid glycosides-Daucosterol, Stigmasterol,^[35] β-Sitosterol,^[36] Others'-P-coumaric acid, p-methoxybenzoic acid, Syringic acid.^[35]

4. Pharmacological properties

Table 2: Pharmacological properties of CLERODENDRUM Inerme.

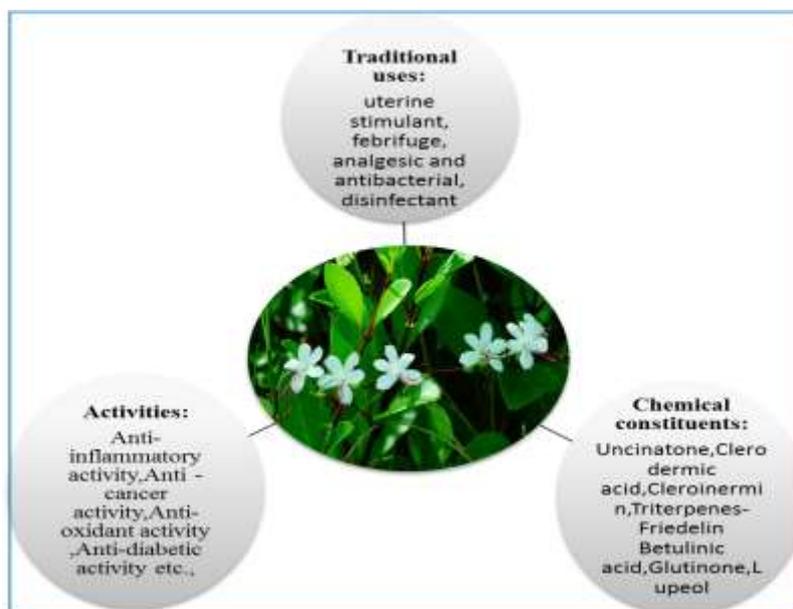
S. No.	Activity	Procedure
1	Anti-Diabetic activity	The evaluation of Clerodendrum inerme's anti-diabetic response has been conducted through both in vitro and in vivo research, including diabetes-induced streptozotocin in mice. Oil ether was used to isolate the C. inerme leaves, and then methanol was added before they were submerged in a solution that would dissolve them. A methanolic concentration of leaves from Clerodendrum inerme showed a strong and steady drop in sugar levels at 200 mg/kg. ^[38]
2	Anti-inflammatory activity	In an attempt to provoke hind paw puffiness, a four-dimensional formalin (20 IL) preparation has been injected into the subplanter area of the left hind paw of mature and capable albino rat males (weight 80–100 g). The inflamed animals had been separated into a total of five groups (six in each one): swollen management, inflamed therapy using indomethacin (at a dose of eight mg/kg subcutaneously), and all three groups of inflammation animals were administered treatment with the TME on a case-by-case basis at doses of 50, 100, and 200 mg/kg subcutaneously (the plant extract was disintegrating in sterile distilled water prior to use). The change in paw width of all examined animals was measured using a Plethysmometer 7150 (UGO, Basil, Italy) at zero, 1, 2, 4, and half a dozen hours after solution answer injection. The examined extract's medication consequences have been determined in contrast to the inflammation-managing region. ^[39]
3	Anti-oxidant activity	The antioxidant power examination was performed through the addition of 0.5 ml of concentrations (200 to 1000 g/ml) plus 0.5 ml of 0.2 M phosphate support (pH 6.6) and 0.5 ml of potassium ferrocyanide (1%). After incubating the combination at fifty degrees Celsius for 20 minutes, 0.5 ml of 10% trichloroacetic acid was incorporated before centrifugation at 3000 rpm for 10 minutes. The absorbance at 700nm was determined using 1 ml of supernatant, 1 ml of refined water, and 0.2 ml of FeCl ₃ (0.1%). ^[40]
4	Anti-malarial activity	C. inerme has been identified as possessing antimalarial properties and hindering the developmental processes of Aedes aegypti, Culex quinque fasciatus, and Culex pipiens larval cells at 80 and 100 ppm quantities of petroleum ether and ether extracts. ^[41]

5	Anti-Carcinogenic activity	Clerodendrum inerme has been used by Indian indigenous physicians to cure an assortment of illnesses, particularly malignancy. Clerodendrum inerme suppresses chemotherapy via controlling macromolecule oxidative damage and inhibiting defensive systems. The ingestion via mouth of Clerodendrum inerme watery extract from leaves at a dosage of 500 mg/kg of body weight substantially decreased the growth of tumours and histological irregularities. Oral therapy using Clerodendrum inerme diminished the quantity of blood vessel and tissue lipids, cell exterior glycoconjugates, and red corpuscle transit ruggedness and efficiency during DMBA-induced oral tumorigenesis. ^[42]
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Table 4: Pharmacological activities reported in *volkameria inermis* by various authors.

S. No.	Plant Part with Extract	Biological Activity	Author And Year	Title	Journal
1.	Ethyl Acetate & Hexane extracts of Leaves & Stem	Anti Fungal Activity	RajasekaranAnitha , et al. 2006	Antifungal Activity Of <i>Clerodendrum Inerme</i> (L). And <i>Clerodendrum Phlomidis</i> (L)	Turk Journal Of Biology
2.	Alcoholic Extract of Leaves & Flowers	Antibacterial Activity Against Escherichia Coli & Staphylococcus Aureus	Surya Prakash Gupta, et al. 2010	<i>Clerodendrum Inerme</i> : An Update Of Its Indigenous Uses, Phytochemistry And Pharmacology	International Journal Chemistry & Science
3.	Ethanollic Extract of Leaves	Hepato Protective Activity	HaqueRabiul, et al. 2011	Hepatoprotective Activity Of <i>Clerodendrum Inerme</i> Against Paracetamol Induced Hepatic Injury In Rats For Pharmaceutical Product	International Journal Of Drug Development And Research
4.	Aqueous extract of Leaves	Analgesic and antipyretic effects	M. Thirumal, et.,al 2013	Analgesic and antipyretic effects of aqueous extract from <i>Clerodendrum inerme</i> (L.) Gaertn. Leaves in animal models	Der Pharmacia Lettre
5.	Alcoholic extracts of Leaves and flowers	Antibacterial activity against Escherichia coli and Staphylococcus aureus	G.S.Chakraborty, et al. 2013	<i>Clerodendrum Inerme</i> : A Current Review	Pharmacophore (An International Research Journal)
6.	Methanolic Extract of Aerial Parts	Anti-Inflammatory Activity	S.R.M.Ibrahim, et al. 2014	Chemical Constituents And Biological Investigations Of The Aerial Parts Of Egyptian <i>Clerodendrum Inerme</i>	Bulletin Of Faculty Of Pharmacy, Cairo University
7.	Ethanollic extract of air dried leaves	Neuroprotective activity	Tzu-Yu Lin ,et al.2014	Acacetin Inhibits Glutamate Release and Prevents Kainic Acid-Induced Neurotoxicity in Rats	PLoS One
8.	Methanolic Extract of Leaves	Anti -Diabetic Activity Anti-Parasitic And Insecticidal Activity	Ali Esmail Al-Snafi, et al. 2016	Chemical Constituents And Pharmacological Effects Of <i>Clerodendrum Inerme</i> - A Review	Smu Medical Journal
9.	Methanolic extract of whole plant	Anti oxidant activity	K. Manjulatha, et al.2016	Phytochemical content and antioxidant potential of <i>Clerodendrum</i>	Journal of Biologically Active Products

				<i>inerme</i> and its different parts-A comparative study	from Nature
10.	Methanolic extract of aerial parts	Anti oxidant and cytotoxic activity	Le Ba Vinh , et al.2017	A new rearranged abietane diterpene from <i>Clerodendrum inerme</i> with antioxidant and cytotoxic activities	Natural Product Research



5. CONCLUSION

Clerodendrum inerme is an appealing therapeutically useful blossoming plant that has traditionally been employed as an anti-diabetic, antibacterial, and for various therapeutic uses. The number and variety of studies on this particular plant are growing day by day as a consequence of its powerful therapeutic effects. Many phytochemical investigations have led to the separate identification of a multitude of powerful chemical substances that function as a foundation for their unique therapeutic actions. Additional investigation will be necessary since this plant expands over tropical and subtropical regions such as Asia, Myanmar, Sri Lanka, and the coastline of India. The purpose of this assessment was to gather the investigation performed by multiple investigators in various locations to date, with the objective of providing an initial foundation for additional research.

6. REFERENCES

- Lashmanasamy, A. et al. 'Evaluation of immunomodulatory activity of *Clerodendrum inerme* on human PBMC', International Journal of Immunology, 2020; 8(2): 33. doi:10.11648/j.iji.20200802.14.
- Chan, E.W., Wong, S.K. and Chan, H.T. 'volkameria inermis: an overview of its chemical constituents and pharmacological properties, notably the Amelioration of Motor Tics', Journal of Herb med Pharmacology, 2023; 12(2): 176–186. doi:10.34172/jhp.2023.18.
- Mahesh Siripuram. 'A REVIEW ON CLERODENDRUM INERME (L) GAERTN', International Journal of Pharmacy and Biological Sciences, 2018; 8: 1077-1081.
- Thao, P.T., Anh, P.L. and Vu, H.S. 'Effect of extraction solvents on quality of Vietnamese tea (*Camellia sinensis* o.kuntze) seed oil', Vietnam Journal of Science and Technology, 2021; 59(2): 137–148. doi:10.15625/2525-2518/59/2/14860.
- Shahabuddin SK, Munikishore R, Trimurtulu G, Gunasekar D, Devillee A, Bodo B. Two new chalcones from the flowers of *Clerodendrum inerme*. Nat Prod Commun, 2013; 8(4): 459-60. PMID: 23738452.
- Nan H, Wu J, Zhang S. A new phenylethanoid glycoside from *Clerodendrum inerme*. Pharmazie, 2005; 60(10): 798-9. PMID: 16259134.
- Ali Esmail Al-Snaf. 'Chemical Constituents and Pharmacological Effects of *Clerodendrum inerme*-A Review, smu medical journal, 2016; 3, 1: 129-152.
- Refaz Ahmad Dar, Mohd Shahnawaz, Saika Rasool, Parvaiz Hassan Qazi, Natural product medicines: A literature update, The Journal of Phytopharmacology, 2017; 7, 6(6): 340-342.
- Komal Patel, Namrata Panchal, Dr. Pradnya Ingle, 'Techniques Adopted for Extraction of Natural Products Extraction Methods: Maceration,

- Percolation, Soxhlet Extraction, Turbo Distillation, Supercritical Fluid Extraction', International Journal of Advanced Research in Chemical Science (IJARCS), 2019; 6, 4: 1-12.
10. Fongang Fotsing Yannick Stéphane, Bankeu Kezetas Jean Jules, Gaber El-Saber Batiha, Iftikhar Ali and Lenta Ndjakou Bruno, 'Extraction of Bioactive Compounds from Medicinal Plants and Herbs', Natural Medicinal Plants, 2021; 9.
 11. Liang, M. et al. 'Physiological measurements and transcriptome survey reveal how semi-mangrove *Clerodendrum inerme* tolerates saline adversity', *Frontiers in Plant Science*, 2022; 13.
 12. Forest Starr, Kim Starr, and Lloyd Loope, January, *Clerodendrum inerme*, United States Geological Survey--Biological Resources Division, 2003.
 13. Lin, Ingrid P, *Clerodendrum inerme*(L.) gaertn. | species - india biodiversity portal, 2023. <https://indiabiodiversity.org/species/show/229225>
 14. *Clerodendrum inerme* (L.) gaertn., https://apps.lucidcentral.org/rainforest/text/entities/cl_erodendrum_inerme.htm
 15. Al-Snafi, Ali. Chemical Constituents and Pharmacological Effects of *Clerodendrum inerme*-A Review. *IOSR Journal of Pharmacy*, 2016; 6(3): 57-67. 6. 57-67.
 16. Ganeshaiiah, K. N., UAS, Bangalore, India. Kailash, B. R., UAS & ATREE, Bangalore, India. Indian Bioresource Information Network (IBIN), Department of Biotechnology, New Delhi, India.
 17. Dr. N Sasidharan (Dr. B P Pal Fellow), Kerala Forest Research Institute, Peechi
 18. G. Renu, SanjanaJuliasThilakar, D. Narasimhan, Centre for Floristic Research, Department of Botany, Madras Christian College, Tambaram.
 19. Lin, Ingrid P, *Clerodendrum inerme*(L.) gaertn. | species - india biodiversity portal, 2023. <https://indiabiodiversity.org/species/show/229225>
 20. *Clerodendrum inerme* (L.)gaertn., https://apps.lucidcentral.org/rainforest/text/entities/cl_erodendrum_inerme.htm
 21. Ali Esmail Al- Snafi, January Chemical Constituents and Pharmacological Effects of *Clerodendrum inerme*- A Review *SMU Medical Journal*, 2016; 3: 1.
 22. Mahesh Siripuram, Sandhya rani Mondi, Krishna Mohan Gottumukkula, MangalaGowri., A REVIEW ON *Clerodendrum Inerme*(L) GAERTN, *International Journal of Pharmacy and Biological Sciences*, 2018; 8: 4.
 23. Achari, B. et al. 'A Clerodane diterpene and other constituents of *Clerodendron Inerme*', *Phytochemistry*, 1990; 29(11): 3671-3673. doi:10.1016/0031-9422(90)85302-v.
 24. El-Shamy, A., El-Shabrawy, A.-R. and El-Fiki, N. 'Phytochemical study of *Clerodendron inerme* L. growing in Egypt', *Zagazig Journal of Pharmaceutical Sciences*, 1996; 5(2): 49-53. doi:10.21608/zjps.1996.185015.
 25. Vendantham, T.N.C., Subramanian, S.S. and Harborne, J.B. '4'-Methylscutellarein and pectolinarigenin from *Clerodendron Inerme*', *Phytochemistry*, 1977; 16(2): 294-294. doi:10.1016/s0031-9422(00)86814-4.
 26. Kanchanapoom, T. et al. 'Megastigmane and iridoid glucosides from *Clerodendrum inerme*', *Phytochemistry*, 2001; 58(2): 333-336. doi:10.1016/s0031-9422(01)00208-4.
 27. Parveen, M. et al. 'A novel lupene-type triterpenic glucoside from the leaves of *clerodendrum inerme*', *Natural Product Research*, 2010; 24(2): 167-176. doi:10.1080/14786410902975566.
 28. Ibrahim, S.R.M. et al. 'Chemical constituents and biological investigations of the aerial parts of Egyptian *Clerodendrum inerme*', *Bulletin of Faculty of Pharmacy, Cairo University*, 2014; 52(2): 165-170. doi:10.1016/j.bfopcu.2014.05.002.
 29. Jacke, G. and Rimpler, H. 'Distribution of iridoid glycosides in *Clerodendrum* species', *Phytochemistry*, 1983a; 22(8): 1729-1734. Doi:10.1016/s0031-9422(00)80260-5.
 30. Kanchanapoom, T. et al. 'Megastigmane and iridoid glucosides from *Clerodendrum inerme*', *Phytochemistry*, 2001; 58(2): 333-336. Doi:10.1016/s0031-9422(01)00208-4.
 31. Çaliş, Gi., Hosny, M. and Yürüker, A. 'Inerminosides A1, C and D, three iridoid glycosides from *Clerodendrum inerme*', *Phytochemistry*, 1994; 37(4): 1083-1085. Doi:10.1016/s0031-9422(00)89533-3.
 32. HH Nan, J Wu, H Yin, S Zhang. 'Terpenoid compounds from *Clerodendrum inerme*', *Chin Tradit Herb Drug*, 2006.
 33. R. Pandey, R.K. Verma, S.C. Singh, M.M. Gupta, '4 α -methyl-24 β -ethyl-5 α -cholesta-14, 25-dien-3 β -ol and 24 β -ethylcholesta, 2023; 5: 9(11).
 34. E-trien-3 β -ol, sterols from *Clerodendrum inerme*, *Phytochemistry*, 2003; 63: 415-420.
 35. P. Raha, A.K. Das, N. Adityachaudhri, P.L. Majumder, 'Cleroinermin, a neoclerodanedieterpenoid from *Clerodendrum inerme*', *Phytochemistry*, 1991; 30: 3812-3814.
 36. H.H. Nan, S. Zhang, J. Wu, 'Chemical constituents from *Clerodendrum inerme*' *Chin Tradit Herb Drugs*, 2005; 36: 492-494.
 37. S.R.M. Ibrahim, K.Z. Alshali, M.A. Fouad, E.S. Elkhayat, R.A.A. Haidari, G.A. Mohamed, 'Chemical constituents and biological investigations of the aerial parts of Egyptian *Clerodendrum inerme*' *BullFac Pharm Cairo Univ*, 2014; 52: 165-170.
 38. T.N. Vendantham, S.S. Subramanian, J.B. Harborne, '4'-methyl-scutellarein and pectolinarigenin from *Clerodendron inerme*'. *Phytochemistry*, 1977; 16: 294-295.
 39. Ali Esmail Al-Snafi*, Chemical Constituents and Pharmacological Effects of *Clerodendrum inerme*- A Review *SMU Medical Journal*, 2016; 3: 1.

40. S.R.M. Ibrahim et al: Chemical constituents and biological investigations of the aerial parts of Egyptian Clerodendrum inerme,. Bulletin of Faculty of Pharmacy, Cairo University, 2014; 52: 165–170.
41. PRASAD M.P.*, SUSHANT S. AND CHIKKASWAMY B.K:Phytochemical analysis, antioxidant potential, antibacterial activity and molecular characterization of clerodendrumspecies International Journal of Molecular Biology, 2012; 3: 3.