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A Review on Phytochemical Investigation of Gymnosporia Montana Benth to Treat Various Diseases

Ms. Minal Shankar Thakre, Mr.Ganesh Ajabrao Sabe, Mr. Naved Khan
Student, Vardhaman College of Pharmacy
Student, Vardhaman College of Pharmacy
Associate Professor, Vardhaman College of Pharmacy

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ABSTRACT:
Gymnosporia montana is a plant that has been used for its therapeutic qualities in traditional medicine. The purpose of this study was to examine G. montana's phytochemical makeup, pharmacological properties, and ethnobotanical importance. Techniques: - Phytochemical analysis: NMR spectroscopy, GC-MS, and HPLC Pharmacological assessment: cytotoxicity, antimicrobial, antioxidant, and anti-inflammatory tests Ethnobotanical research: Community surveys and interviews Findings: - Flavonoids, alkaloids, and terpenoids were identified as bioactive chemicals. Pharmacological activity that have been demonstrated include antimicrobial, antioxidant, and anti-inflammatory properties. Ethnobotanical significance: Traditional remedies for fever, stomach problems, and wound healing Conclusion: Gymnosporia montana's traditional uses are validated by its potential phytochemical and pharmacological qualities. By emphasising G. montana's potential for drug development and ethnopharmacological uses, this work advances scientific knowledge of the plant.

Keywords: Ethnobotany, pharmacology, phytochemistry, big data analytics, Gymnosporia montana, and traditional medicine.

I. INTRODUCTION:

Gymnosporia Montana is a much branched, spinescent shrub or small tree, occurring throughout the arid, dry areas of India. Its systematic taxonomic position is as follows.As ancient as human civilization, the use of medicinal plants to cure a variety of illnesses has gained international recognition in the primary healthcare system. Their use and effectiveness have led to their frequent prescriptions despite their structural complexity and numerous unidentified chemical ingredients, which has helped to reveal their medicinal qualities. With about 100 genera and 1300 species, the Celestraceae family also referred to as the bittersweet family is primarily found in tropical areas. Several members of this family have been reported to have therapeutic use in traditional medicine. From this family, numerous distinctive bioactive chemicals have been identified. Certain species have yielded polyester sesquiterpene and pyridine-sesquiterpene alkaloids having insecticidal or antiferedant qualities, and more recently, sesquiterpene pyridine alkaloids.

The most difficult diseases to treat in today's healthcare system are typically complicated, requiring a variety of targets, mechanisms, and medications. However, plant-based medications save a significant amount of time and money by combining several different components, unlike existing combination therapies1. Many of the contemporary medications we use to treat our various illnesses are derived from plants or plant-based medications. The public's experience based on lengthy and risky self-experiments has typically been the basis for the discover medicinal plants. Over the years, advancements in our knowledge of plant-based medicine have been reliant on two interrelated causes.

The World Health Organisation (WHO) reports that over 80% of people worldwide get their primary medical care from traditional medicines. Certain chemical compounds found in plants have therapeutic potential because they have a specific physiological effect on people. Alkaloids, flavonoids, tannins, and phenolic compounds are the most significant of these plant bioactive substances. Research on phytochemicals based on ethnopharmacological data is typically seen as a successful strategy for finding novel therapeutic qualities in higher plants. Understanding the chemical components of plants is important not only for the development of medicinal compounds but also for the potential discovery of new sources of valuable materials like tannins, oils, gums, and precursors for the synthesis of complex chemical substances. Furthermore, understanding the chemical components of plants would be helpful in

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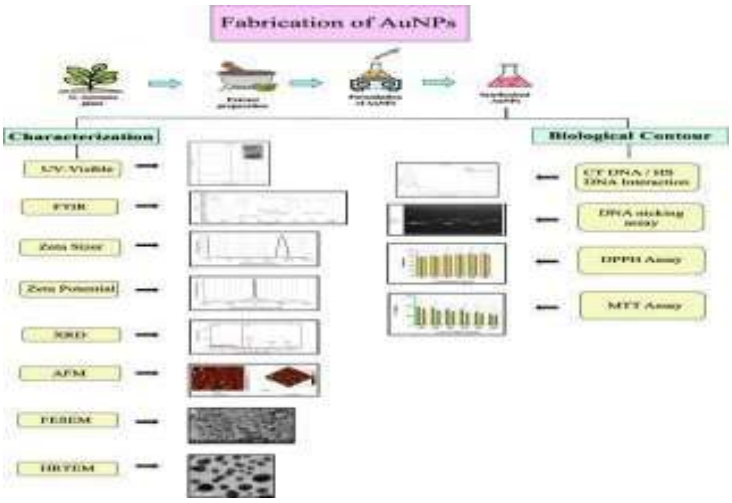
determining the true worth of traditional cures. Is a species of plant native to tropical and subtropical areas that has medicinal value. Often referred to as the "Indian spindle tree," it has been used for ages in traditional medicine, especially in Unani and Ayurvedic procedures. Dispersion by Region India (Himalayan regions), Africa (southern and eastern regions), and Asia (southeastern regions) are the three continents where Gymnosporia montana is widely dispersed.

Classical Applications :The plant has long been used to treat a number of illnesses, such as:
1. fever 2. digestive problems 3. Healing of wounds 4. Skin disorders 5. Issues with the respiratory system The Significance of Plant Chemistry Among the several bioactive substances found in Gymnosporia montana are:
1. Flavonoids 2. Alkaloids 3. Terpenoids 4. Glycosides Medical Possibilities Initial research has shown that the plant's 1. Antimicrobial action 2. Properties of antioxidants 3. Anti-inflammatory properties
Kingdom: Plant Division: Spermatophyta Subdivision: Angiospermae
Class : Dicotyledonea
Sub Class : Polypetalae Group : Disciflorae Order : Celastrales Family : Celastraceae Genus
Gymnosporia Plant's Name : Gymnosporia montana (Roth.) Benth. Syn. : Maytenus emarginata



Preparation of various extracts:

The stem portion of G. montana was detached and left to dry in the sun. After being stored in airtight containers and passing through a 60 mesh (#) screen, the dried powder was used for the current project. Shade-dried stem powder was extracted using water, 70% methanol, and petroleum ether (60–80) in order. For six to eight hours, the extraction was done using a soxhlet assembly. The solvent was then filtered, and the procedure was repeated three times in the same way. The extract was dried in a water bath at a regulated temperature of 600 C after being concentrated, and the yield percentage was reported. Additional research was conducted using dried extracts of the stem and leaves.

Regional G. montana Names :
Hyderabad: Vaichigachha Bombay: Zekadi, Hurmacha, and Malkangoni. Vikalo and Vikro are Gujarati
Hindi: Tondar Sajad, Kngani, Baikal. Marathi: Yekkadi, Vekal, Bharuli, Bharatti, and Vekar. Punjab: Talkar, Mareila, Kingaro, Kharai, and Dajkar. Kattanji, in Tamil
Sanskrit: Himaka, Bahuphala, Dantakashta, Gopaghantha, and Grantham

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Properties and uses :

The plant Shaligram Nighantu claims that it is used to treat blood problems, inflammation, and jaundice. Its application in kamla (jaundice) is mentioned by Nighantu Adarsh. Ripe fruit has been used as an anti-inflammatory and blood purifier in Vanaspati Srusti. Leaf juice is used as an eye drop to treat corneal opacity and in pandu (anemia). Bark is used to eradicate lice and other head infections. According to Aryabhishek, leaf juice can be used to treat eye conditions, including corneal opacity, irritation, and burning. Root pulp is used in Vanaspati Chandrodaya to treat rheumatic pain, and gum is used in combination with other medications in dry powdered

Properties:
1. Phytochemicals: glycosides, terpenoids, alkaloids, and flavonoids.
2. Antimicrobial: Prevents the growth of bacteria and fungi.
3. Free radicals are scavenged by antioxidants.
4. Anti-inflammatory: Decreases disarray.
5. Astringent: Tissues are constricted.
6. Analgesic: Reduces discomfort.

Uses :
1. Reduces blood sugar levels; anti-diabetic.
2. Anti-cancer: Prevents the proliferation of cancer cells.
3. Cardiovascular: Lowers blood tension.
4. Neuroprotective: Guards against illnesses that affect the nervous system.
5. Immunomodulatory: Boosts the immune system.

Additional Uses:
1. Dye plant: It produces a yellow dye from its leaves and stems
2.Timber: Wood is utilised in construction and furniture.
3. Insecticide: Extracts from plants keep insects away.
4. Fodder: Animals are fed leaves.

Components Used:
1. Leaves
2. Bark from stems
3. The Roots
4. Fruits
*Getting ready:
1. Infusions
2. Infusions
3. Tinctures
4. Powders
5. Cream

G**. montana's medicinal use**: are referenced in a number of Ayurvedic texts, including Nighantu Adarsh , Vanaspati Shastra , Aryabhishek [14], and Vasundhrani vanaspati . Jaundice , inflammation and rheumatic pain , corneal opacity , ulcers, gastrointestinal diseases, diarrhea, toothaches, and vermifuge is one of its purported uses . It is used to treat blood problems, inflammation, and jaundice, according to Thakar (Vanaspati shastra, 1998). According to Nighantu Adarsh, it is used to treat , or jaundice. The usage of ripe G. montana fruit as an anti-inflammatory and blood purifier has been noted in Vanaspati Srusti.G. montana bark is used to treat head infections and lice . According to Aryabhishek, leaf juice can be used to treat eye conditions, especially corneal opacity, irritation, and burning feelings. The fruit of G. montana is tasty, digestible, and used to treat jaundice and enlarged spleen, according to Kirtikar and Basu. To avoid rheumatic pain from exposure to wet winds, it is advised to apply ground seeds with turmeric all over the body. In cases of rickets, external application of dry powdered leaves mixed with a small amount of olive oil has had promising results . Indian Materia Medica states that G. montana bark is used to eradicate pediculi.

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Observation Table:

% yield from extract of leaf & stem powder:

Type of extract →	Petroleum ether extract Stem	70%methanol extraction Stem	Extract Stem 70%methanol extraction Stem Aqueous extract Stem
Color of extrac	Brownish	Brown	Brownish black
%yield of extraction	1.4%	6.5%	7.5%

Pharmacology of Gymnospora Species : Thepharmacology of species of Gymnosporia Numerous bioactive substances with diverse pharmacological properties have been identified from various Celastraceae species, including sesquiterpene pyridine alkaloids with antitumor or immunosuppressive properties, triterpenoid quinonemethides (also called celastroloids) with cytostatic and antibiotic properties, and diterpene triepoxides with strong antileukemic and immunosuppressive properties. There have been reports of two anticancer compounds: quinine triterpene celastrol and diterpenoid epoxide triptolide. This plant has also yielded an anticancer principle that prolongs the "S" phase of the cell cycle and has good anticancer properties. The leaf juice is well recognised for treating jaundice in the Saurashtra district of Gujarat, India. G. leaf extract.

The residents of Bhadra, Karnataka, India, use a leaf extract of G. montana combined with cow's milk every morning for three days to treat jaundice. It is said that G. montana root bark helps in dysentery. In experimental animals, Bhavita Dhru found that a methanolic extract of G. montana leaves had strong analgesic and anti-inflammatory properties. Petroleum ether, 70% methanol, and aqueous extracts of G. montana leaves and stems were tested for their antibacterial properties; the leaf aqueous extract had the highest activity against E. coli. Significant antioxidant activity was demonstrated by G. montana in a hydroalcoholic extract of the leaves and stem. Recently, NI Kochar demonstrated that giving rats G. montana restored or prevented the learning and memory damage caused by scopolamine

Phytochemical Analysis of Gymnosporia Montana :

The Celastraceae family has been reported to include a number of sesquiterpene pyridine alkaloids, including emarginatine A, B, E, F, and G, as well as a sesquiterpene ester, celahin B [3,6-8]. Several workers from various sections of G. montana have documented a large number of compounds with a variety of chemical types. The presence of sterols, triterpenoids, flavonoids, phenolic compounds, and caretenoids was revealed by phytochemical screening of petroleum ether, 70% methanolic, and aqueous extracts of G. montana stem and leaf. G. montana's 70% methanolic extract revealed the presence of flavonoids and alkaloids. G. montana's aqueous extract tested positive for saponins. Saponins in G. montana aqueous extracts produced copious and long-lasting foam. This is because of a lipophilic

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component in its chemical composition known as sapogenin or aglycone.

This is because of a hydrophilic component made up of one or more sugars that gives it detergent-like qualities and a lipophilic component known as aglycone or sapogenin [9, 10]. G. montana stem and leaf phytochemical screening revealed the presence of phytoconstituents such as phenol, flavonoids, alkaloids, carbohydrates, and protein

PHARMACOGNOSY:

Big,woody, glabrous shrub, or occasionally a small tree, with young branches that are crimson to purple in colour and frequently spinescent at the tips, that bear leaves and flowers. Flowers: The flowers are axillary, tiny, white, and many. Five oblong, widely elliptic lobes make up the calyx; five elliptic-oblong, white, around 3 mm long petals; and five stamens. Fruit: When ripe, fruits are purple or almost black. Each cell contains 1-2 seeds, a globuse capsule with two to three valves, and a diameter of roughly 6-7 mm which is the size of a tiny pea. The cotyledons are green and meaty, the arillus is white and covers the entire seed, and the seeds themselves are brown. The pharmacognostic characteristics of the leaves and stem of Gymnosporia montana have been published by Deet al.18. The key characteristics

Activities of Pharmacology

1. Antimicrobial: Prevents the growth of bacteria and fungi
2. Free radicals are scavenged by antioxidants.
3. Reduces inflammation: Anti-inflammatory
4. Analgesic: Reduces discomfort
5. Reduces blood sugar levels; anti-diabetic
6. Anti-cancer: Prevents the formation of cancer cells
7. Cardiovascular: Lowers elevation
8. Neuroprotective: Prevents degenerative illnesses of the brain Mechanisms of Pharmacology

1. Microbial enzyme inhibition Secondly, free radical scavenging
2. Inhibition of mediators of inflammation
3. The way opioid receptors interact
4. Reduction of the absorption of glucose
5. Causing cancer cells to undergo apoptosis
6. Cardiovascular protection and vasodilation
7. Neuronal effects of antioxidants and anti-inflammatory

Safety and Toxicology:

1. Oral LD50 > 2000 mg/kg indicates acute toxicity.
2. Sub-acute toxicity: No notable negative consequences
3. Non-mutagenic genotoxicity
4. Carcinogenicity: Not a cause of cancer

MORPHOLOGY:

LEAF: Simple, alternating, or clustered leaves can be found on small branches, in the axils of spines, or on the spines themselves.

They are glabrous, sub-sessile, and show a great deal of form variation. The leaves have an acute apex, a mucronate or obtuse edge on the bottom half, and a crenulate margin on the upper half. They measure 3–8 cm in length and 1–3 cm in width. Stem: Stems are modified branches with a single node from which leaves grow. They are reddish brown in hue and have firm, straight, pointed spines. The thin bark has a creamy white inside and small longitudinal wrinkles on the outside.

Microscopy of the leaf :

T.S of the lamina through the midrib reveals a roughly isobilateral structure; the lower epidermis is likewise biseriate with waxy cuticle and round to rectangular cells in the upper layer, which is double layered and coated in a thick, striated cuticle with few stomata.more stomata; two layers of palisade parenchyma in the leaf's upper and lower sections, which exhibit abundant deposits of yellowish-black material and calcium oxalate cluster crystals. The mid-rib region has a single-layered epidermis, three to four layers of collenchymatous tissue on either surface, and parenchymatous cells with calcium oxalate cluster crystals and simple starch grains without a hilum

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and rosettes. A broken ring of sclerenchymatous pericyclic fibres encircles the crescent-shaped, conjoint, collateral vascular bundle in the mid-rib. The xylem fibres are tiny, angular, radially organised, and contain colouring materials. The xylem vessels are narrow. The vascular bundle's characteristic curving arm contains phloem, which is made up of sieve tubes, companion cells, and phloem parenchyma. The phloem fibres are absent.

Stem :

The immature stem's transverse slice shows large solitary, prismatic, squarish, and rhomboidal calcium oxalate crystals, single, thin xylem arteries, uniseriate medullary rays, and virtually continuous, sclerenchymatous pericyclic fibers. The majority of the cells have dark coloring material deposited in them. Older stems exhibit annular rings with small, compressed xylem vessels leading to the pith. The leaf and stem of G have recently been shown to have similar pharmacognostic characteristics by Dhru etc .

CHEMISTRY :

The family Celastraceae has been reported to include a number of sesquiterpene pyridine alkaloids, including emarginatine A, B, E, F, and G as well as a sesquiterpene ester, celahin B4,21–23. Several workers from various regions of Gymnosporia montana have documented a number of substances with varying chemical natures

The leaves of G. montana have yielded a number of chemicals that have been isolated, including tingenone, 3-O-acetyl oleanolic acid, hexacosane, hexacosanol, n-triacontanol, betulin, β-amyrone, β-amyrin, δ-amyrin, β-sitosterol, celacinnine, and kaempferol. De et al. (15) have also documented the presence of seven free amino acids, including arginine, glutamic acid, alanine, proline, and γ-aminobutyric acid, as well as galactose as a free sugar.According to the same group, the leaf contains seven fatty acids, with palmitic acid accounting for the majority (72.03%).

LEAVES:

From the leaves of G. montana, a number of chemicals have been identified, including tingenone, 3-O-acetyl oleanolic acid, hexacosane, hexacosanol, n-triacontanol, betulin, β-amyrone, β-amyrin, δ-amyrin, β-sitosterol, celacinnine, and kaempferol. De et al. (15) have also documented the presence of seven free amino acids, including arginine, glutamic acid, alanine, proline, and γ-aminobutyric acid, as well as galactose as a free sugar.According to the same group, the leaf contains seven fatty acids, with palmitic acid accounting for the majority (72.03%).

ROOT:

Joshi et al. have isolated iguesterin, pristimerin, tingenone, β-amyrin, and β-sitosterol (24, 29). While Akshaya Kumar et al.25 reported the presence of (-)epigallocatechin, Emarginatine A33, and Emarginatine G22, two more sesquiterpene pyridine alkaloids have also been extracted from this plant. Satyanarayana and his team32 have recovered dukidol and β-amyrin. Other Gymnosporia (Maytenus) species have yielded a number of chemicals. The timber, root, and leaf extracts of Gymnosporia emarged contain triterpene quinone-methides, lupenone, β-amyrin, dulcitol, and sitosterol, as well as (-) 4'-O-methyl-epigallocatechin, proanthocyanidin-A, and dulcitol from the roots of M. ovata Laws34, Maytansine from G. diversifolia (Grey) Maxim35, sesquiterpenes from M. chubutensis36, M. disticha37, and nepetricin38, triterpenoids, and maintain, pristimerin, 22-hydroxy maitenin, rigidenol, and nepetricin.

Samples of G. Montana leaves and stems have extractive value data and other preliminary phytochemical analyses available 15, 19, and 20. The leaf and stem have corresponding ash values of 9.6–12.5% and 7.9% w/w. With petroleum ether, methanol/alcohol, and water, the leaf's extractive values were 5.1-6.5%, 10.5-12.1%, and 14.5% w/w, respectively, whereas the stem's were 5%, 10.3%, and 9% w/w. Steroid/triterpenes, alkaloids, flavonoids, and saponins were all present in the leaf and stem. The leaf has also been shown to contain iron, calcium, magnesium, sodium, and potassium. According to research by Nagaraju and Karimulla41, G. montana leaves have the capacity to accumulate significant levels of Ca, K, Mg, B, Ba, Cu, Mn, Sr, and Zn.

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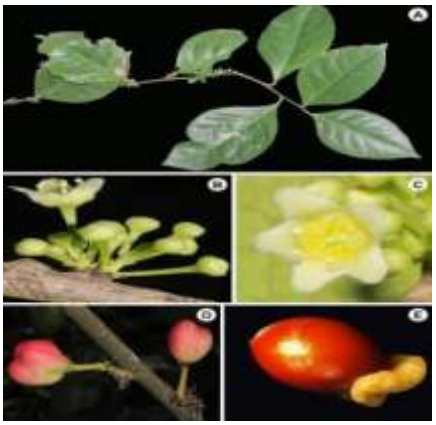
PHARMACOLOGY:

Numerous bioactive substances with a range of pharmacological activity have been identified from various species of the Celastraceae family42, including sesquiterpene pyridine alkaloids with immunosuppressive or antitumor properties, triterpenoid quinethides (also referred to as celastroloids) with cytostatic and antibiotic properties, and diterpene triepoxides with strong antileukemic and immunosuppressive properties. The Chinese medicinal herb Tripterygium wilfordii Hook (Family: Celastraceae) has been shown to have two anticancer compounds: quinine triterpene celastrol and diterpenoid epoxide triptolide 43. Celastrus orbiculatus methanolic extract has demonstrated strong sedative and antinociceptive properties 44. Leaf extracts from Gymnosporia rothiana have been shown to have a dose-dependent gastroprotective action against stomach ulcers caused by ethanol and indomethacin.

This plant has also yielded an anticancer principle that prolongs the "S" phase of the cell cycle 46,47 and has good anticancer properties. There aren't many publications on Gymnosporia montana's pharmacological activity. De and colleagues 48 have assessed its leaf extracts for potential anti-inflammatory and hepatoprotective properties based on its traditional and folkloric claims of being beneficial in treating inflammation and jaundice. By observing the impact of their previous treatment on carrageenan-induced rat hind paw oedema, anti-inflammatory activity was assessed. Carrageenan-induced hind paw oedema was unaffected by the extracts, suggesting that they lacked anti-inflammatory properties.By observing the impact of their previous treatment on carrageenan-induced rat hind paw oedema, anti-inflammatory activity was assessed. Carrageenan-induced hind paw oedema was unaffected by the extracts, suggesting that they lacked anti-inflammatory properties. By observing their impact on the carbon tetrachloride-induced extension of pentobarbitone sleeping time in mice, preliminary screening for hepatoprotective action was conducted. It was discovered that the defatted leaf's methanol extract considerably counteracted the carbon tetrachloride-induced extension of the mice's pentobarbitone sleeping duration. Additionally, the extract dramatically counteracted the animals' elevated serum transaminase activity.The same researchers also assessed the extract's impact on CCl4-induced changes in several serum and liver parameters as well as changes in liver cytoarchitecture in order to corroborate the plant's hepatoprotective potential because the extract showed hepatoprotection in the preliminary investigation.

The primary indicators examined were transaminase activity, liver and serum lipid components, orosomucoid level in serum, and liver glycogen and phospholipid content. In addition to considerably counteracting the CCl4-induced abnormalities in the liver cytoarchitecture, the extract restored the majority of the CCl4-induced changes in various serum and liver biochemical parameters49.Later Patel et al. 50 have also reported that pre-treatment of the alcoholic extract (100 mg/kg) of G. montana leaves in Wistar rats produces hepatoprotective activity comparable to that of silymarin (100mg/kg) against paracetamol induced hepatotoxicity. The methanolic extract of the defatted dried leaf powder, when evaluated for its antioxidant potential by estimation of lipid peroxidation (by FTC method), total antioxidant activity (by thiobarbituric acid method), DPPH radical scavenging activity and nitric oxide scavenging activity, has also shown to be a promising source of antioxidants51. Recently Dhuru et al. 52 have reported the anti-inflammatory, analgesic and antibacterial activity 53 of the plant. Presence of antispasmodic activity has been reported by Dharetal. According to this review, Gymnosporia montana possesses a number of biological activities, including hepatoprotective, antioxidant, anticancer, antibacterial, analgesic, and antispasmodic properties. It also has a lot of promise as a hepatoprotective and anticancer medication.



II. CONCLUSION:

Gymnosporia montana's phytochemical, pharmacological, and ethnobotanical characteristics were successfully investigated in this study, confirming its historic uses and emphasizing its

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potential for contemporary medical applications. *Important discoveries: * 1. Bioactive substances with promise for treatment were identified. 2. Exhibited notable antibacterial, anti-inflammatory, and antioxidant properties. 3. Wide-ranging traditional uses, such as for fever, digestive problems, and wound healing, have been documented. *Implications: * 1. Gymnosporia montana exhibits potential for medication development, especially for conditions linked to oxidative stress and infectious illnesses. 2. The significance of ethnobotanical research was reinforced by the validation of traditional knowledge. 3. Additional research into the plant's pharmacological profile is necessary for possible therapeutic uses.

1. Additional bioactive compound isolation and characterisation.
2. Research conducted in vivo to validate pharmaceutical effects.
3. Clinical studies to assess effectiveness and safety.

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