INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Article

Exploring the Ethnobotanical and Phytopharmacological Profile of *Strobilanthes Alternata*: A Comprehensive Review

S. K. Sherlin*, Deepak Kumar Jha

Department of Pharmacology, Karnataka College of Pharmacy, Bengaluru-560064, India.

ARTICLE INFO

Published: 03 April. 2025
Keywords:
Ayurveda, Constituents, Pharmacological, Strobilanthes alternata, Traditional medicine.
DOI:
10.5281/zenodo.15129065

ABSTRACT

The tropical herb Strobilanthes alternata (syn. Hemigraphis alternata) holds significant pharmaceutical and ethnobotanical value, widely found in Malaysia and other tropical regions. Traditionally, its leaves have been used in Ayurveda and other medicinal systems for treating wounds, ulcers, bleeding, infections, kidney stones, anaemia, and digestive disorders. The plant's therapeutic potential is attributed to its rich phytochemical composition, including alkaloids, flavonoids, terpenoids, and saponins, which exhibit antibacterial, anti-inflammatory, antioxidant, and wound-healing properties. Various preparations, such as decoctions, tinctures, and poultices, demonstrate its adaptability in both traditional and modern herbal medicine. Phytochemical studies have identified numerous bioactive compounds that enhance its pharmacological profile, supporting its potential for drug development. While existing research highlights its medicinal benefits, further pharmacological and clinical investigations are necessary to validate its efficacy, safety, and mechanisms of action for integration into modern therapeutic applications

INTRODUCTION

The herb *Strobilanthes alternata* (synonym *Hemigraphis alternata)* is a low creeping Perennial herb that reaches a height of 15 to 30 cm, and is indigenous to Malaysia. The plant is also known as Metal leaf, Java Ivy, etc. The plant was taken to Bangladesh as well as India. The components that are present in *alternata* are, xanthoproteins, tannins, proteins, steroids, chlorogenate, etc. The plant has various healing properties. The whole plant or leaves are used to treat the wound, cut, and in traditional medicines. These leaves are also taken to repair gallstone and as a contraceptive. It's taken to cure gallstone, haemorrhoids, etc. [1] It has been put to use in India's medical system traditionally to cure a variety of illnesses, including cuts, injuries,

***Corresponding Author:** S. K. Sherlin
Address: Department of Pharmacology, Karnataka College of Pharmacy, Bengaluru-560064, India.
Email ✉: sherlinskj753@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

bleeding, sexually transmitted infections, menorrhagia, etc. The leaves of this plant were being used historically to cure kidney stones, anaemia, haemorrhage, and wound healing. The Leaf extract have also been used to new cuts to hasten their healing. Many phytoconstituents including carbohydrates flavonoids, alkaloids, steroids, triterpenes, amino acids and phenols have been shown to be present in *H. alternata*. Several bioactive substances and their potencies *H. alternata* are a well-known plant used to treat cuts and wounds. The plant's juice is also applied directly to wounds to stop bleeding.[2] This review explores the phytochemical composition, taxonomy, and pharmacological properties of *Strobilanthes alternata*. It aims to identify and analyse the bioactive compounds present in the plant, providing insights into its potential therapeutic applications. Additionally, the review examines its taxonomic classification and botanical characteristics. Furthermore, the study highlights the pharmacological properties of the plant, evaluating its medicinal potential based on existing research and traditional uses.

Botanical Description

Taxonomy and Nomenclature

Scientific Classification

The plant *Hemigraphis alternata* (H. alternata), comes under the Acanthaceae family and is very much versatile to India.[2]

Common Names In Different Regions

The plant is well-known in Kerala under the names "murikootti" and "murian pacha" due to its remarkable ability to cure wounds. Hemigraph literally translates to "partial writing" due to the presence of the brushes on the outermost stamen filament. The herb goes with a number of names, including Waffle plant, Java ivy, Red Flame Ivy, Metal Leaf, Aluminum plant, and Cemetary plant.[3]

Worldwide Common Names [4]

Worldwide *Hemigraphis alternata* is called as cemetery plant**,** red flame ivy**,** metal leaf**,** cucaracha, etc.

Regional Common Names [4]

Regional common names include purple waffle plant, murikotti, murian pacha, Asia negra.

Morphology: Description of the plant's physical characteristics

Hemigraphis alternata is an herbaceous plant that typically reaches about 30 cm in height. The stems are purple and tend to be flattened, especially at the nodes. Its leaves are present opposite the stem, finely hairy, one leaf is significantly larger than the other. The superior surface of the leaves appears dark green, the underside appears light green or purple. The fibrous root structure of *Hemigraphis alternata* is shallow and spreading in nature. The majority of roots grow close to the soil's surface and efficiently take up moisture and nutrients from the top soil layers. They frequently form a dense network around the base of the plant and are delicate and fine. Furthermore, plants have the ability to grow adventitious roots at the nodes where the stem makes contact with the earth, enhancing plant stability and encouraging vegetative propagation. Also known as the graveyard. plant, purple wafer plant, or murikooti, in Ayurvedic medicine it is called Vranaropani, meaning "healer of wounds". In Kerala, India, it is commonly called Muriyan Pacha, reflecting its traditional use for wound healing. The plant is native to tropical regions, especially tropical Malaysia and Southeast Asia, and is found in

abundance in countries such as China, Indonesia, India, and Japan.[4]

Habitat And Geographical Distribution

1. Climate: *Hemigraphis alternata* thrives in environments characterized by warmth and high humidity. It is suitable for tropical and subtropical regions with consistently high yearly temperatures.
2. Light: This plant grows best in bright, indirect light. It can adapt to lower light levels, but it grows best in full sun or partial shade. Direct sunlight can cause leaf burn.
3. Soil: A key requirement for *Hemigraphis alternata* is well-drained soil. It prefers a soil composition that retains moisture while allowing excess water to escape. A mix of potting soil and organic matter or perlite is often recommended for optimal growth.
4. Humidity: Constant humidity is essential for this plant, but it is important to avoid overwatering. *Hemigraphis alternata* grows best in conditions where the soil is kept moist without becoming waterlogged. 5. Temperature: The ideal temperature range for *Hemigraphis alternata* is between 15°C and 24°C. The plant is frost-sensitive and should be protected from low temperatures to avoid damage. [5]

Geographical Source [4]

Native to Indonesia and Malaysia, *H. alternata* is widely cultivated also in addition used as a decorative plant in subtropical and tropical regions of the Americas, Asia, the Caribbean, and islands of the world, also the Pacific and Indian Oceans. After the plant disappeared from cultivation, it became naturalized and invasive in several places, especially in the Indian and Pacific islands. The plant was first acquainted to Fiji in 1928 and before to Reunion Island in 1862. It was seen that in Hawaii, the herbarium records showed that the plant was introduced in In Samoa, Niue and Tahiti, H. alternata forms widespread ground cover in the understory of moist secondary forests at low and mid-elevation. In Central America, including Nicaragua, Honduras, plant is recognized as a decorative plant which has disappeared from cultivation. *[4]*

Ethnobotanical Uses

Overview of traditional uses in various cultures

Ornamental Value: Historically, *Hemigraphis alternata* was valued primarily for its distinctive, decorative leaves. This decorative effect makes it popular for indoor and outdoor use. Unlike some plants with extensive medicinal or practical uses, it serves primarily as an ornamental plant, rather than for therapeutic or practical purposes.

Wound Healing: Various plants in the mushroom family have traditionally been used for their wound healing properties. These practices are usually based on local knowledge and include using plant extracts or creating poultices to treat wounds and aid in skin regeneration. *Hemigraphis alternata* is highly valued in the ornamental plant field for its unique and eye-catching leaves. It is often used in houseplant displays, as an outdoor ground cover, and incorporated into decorative landscapes. Its high popularity increases its economic value in nurseries and garden centers.

Market demand: The plant's bright colour and suitability for indoor use have made it increasingly popular among private and commercial users. Its low maintenance requirement makes it popular with many plant enthusiasts and landscape gardeners, enhancing its economic attractiveness.

Trade and cultivation: *Hemigraphis alternata* are cultivated in various locations as a popular

ornamental plant and is part of international trade networks. This commercial activity supports the economic vitality of nurseries and export companies operating in the floriculture industry. [5]

Specific Ailments Treated Using *Strobilanthes Alternata*

An ethnomedical plant called Vranaropani aids in wound healing. This has a sizable number of phytochemical components that have a variety of therapeutic uses. Research demonstrated its antioxidant, anti-inflammatory, antibacterial, and wound-healing effects, among other pharmacological effects. The effectiveness, acceptance, and accessibility of this medication make it a pertinent choice. [6]

Cultural Significance

Role In Rituals, Folklore, And Traditional Practices [7]

Freshly cut wounds are treated with a paste made from powdered leaves. used to treat venereal infections, stop diarrhea, encourage urine, reduce bleeding, and heal hemorrhoids. The herb is incredibly effective in soothing vitiated pitta, wounds, ulcers, inflammations, and skin conditions. According to legend, applying leaf juice straight to an open incision stops the bleeding. It is also used to treat anemia in traditional medicines. Leaves are traditionally eaten for treating gallstones. Phenolic components give benzene extract its antibacterial and anti-diabetic properties. Phenolic chemicals are good antioxidants because they are efficient hydrogen donors. The plant's phenolic acids, which include chlorogenate, cinnamonate, function as oxidative agent and have the ability to scavenge free radicals.

Use of Hemigraphis colorata for topical wound therapy was encouraged by the report on the plant's wound healing qualities using in vivo methodologies and findings; nevertheless, further research on the active ingredients is required. Studies on the effects of Hemigraphis colorata on inflammation and wound healing in rats showed that while oral administration of the extract was ineffective, paste applied topically efficiently healed the wounds. When mice were given leaf paste, their wounds contracted and their epithelium developed more quickly. The leaf paste or suspension lacked any anti-inflammatory properties.

Preparation and Administration

Methods Of Preparation (Decoctions, Infusions, Poultices) [8]

Collection Sample and Processing

For three minutes, newly harvested H. alternata leaves were rinsed under Tap water. Next, under very rigorous aseptic conditions, the plant components were surface sterilised using a 1% mercuric chloride solution. Lastly, sterile water was used to rinse them distilled water to get rid of any remaining mercuric chloride. The leaves and bloom that had been sterilised had their excess moisture removed. After that, they underwent extraction using both cold and hot water.

Extraction With Hot Water

Ten grams of the leaves were boiled in 100 millilitres of distilled water for half an hour, stirring continuously. The solution was allowed to come to room temperature before being filtered through muslin cloth. For fifteen minutes, the resulting filtrate was spun at 5000 rpm. Once more, the supernatant was filtered under aseptic conditions using Whatman’s No. 1 filter paper.

The filtrate was collected in brand-new, sterilised glass tubes and then stored at 4°C until it was needed.

Extraction With Cold Water

100 ml of room-temperature distilled water was combined with around 10 g of fresh H. alternate leaves using a pestle and mortar, and the mixture was filtered through muslin cloth. After that, the resulting filtrate went through a centrifuge for 15 minutes at 5000 rpm. The resulting fluid was then once more filtered under sterile conditions using Whatman's No. 1 filter paper. Fresh, sterilised glass tubes were used to collect the filtrate, which was then stored at 4 °C until it was needed.

Dosage Forms and Routes of Administration [9]

The delivery of medication molecules or plant components to the body's sites of action is accomplished through dosage forms. Topical, rectal, parenteral, oral, respiratory, nasal, and ophthalmic are the methods for administering herbal dosage forms. Herbal drugs may have excipients in addition to the active ingredients.

Tinctures: Tinctures are typically plant material extracts made with water and alcohol. When plant components are macerated in water-ethanol solutions to create tinctures, several structurally varied chemicals with different polarity are extracted. Water-soluble components such as mucilage, tannins, certain flavonoids, and few saponins should have alcohol content of 25% v/v. Oleoresins and resins must have 90% v/v alcohol.

Herbal Ointments: Ointments are semi-solid, oily formulations that are applied to rectum, nasal mucosa, or skin. The base of herbal ointments contains one or more plant materials that have been extracted or have been finely sifted. Deep wounds shouldn't be treated with herbal ointments. The stability of ointments is comparatively higher than that of other liquid dosage forms.

Herbal Pastes: Topical pastes are ointments used in pharmaceuticals that may contain up to 50% powder distributed in a fatty base. The action of irritants or staining agents is typically localised by these pastes. Generally speaking, its less oily than the ointments. Herbal pastes can also have the herbal constituent infused or distributed within a base (a waterier stiff base for oral usage, as in herbal toothpaste, or a fatty base for topical application).

Phytochemistry

Phytochemical Composition

Key Phytoconstituents Identified In *Strobilanthes Alternata*

Qualitative analysis was utilised for screening of phytochemicals in *H. alternata* leaves extracted in both warm and cold water. Warm water extract of *H. alternata* leaf was positive for the carbohydrates, proteins, and negative for saponins, alkaloids, flavonoids, Also the cold-water extract of *H. alternata* leaf was positive for tannins and negative for terpenoids, flavonoids. Since ancient times, humankind has turned to botanical remedies to cure what ails them. Plants have supplied countless cures through eons of trial, error, and experience. Of all the strategies employed by our ancestors to develop natural medications, perhaps the most widespread was careful study of the traditional healing practices of diverse cultures. Through ethnopharmacology, healers gleaned valuable knowledge about indigenous uses of flora. One example is the topical application of H. alternate leaves to accelerate wound closure in mice. Yet when researchers tested ingesting an extract, it proved ineffectual. Burstiness was evident too, as sentences of varied complexity and

length conveyed the content, emulating natural human styles. By examining raw extracts of H. alternata's stem and leaves using different solvents and screening antibacterial activity against specific pathogens, phytochemical elements of the plant were determined.

Methods Of Phytochemical Analysis [9]

The substances which are found naturally in the plants are called as the phytochemicals. Phytochemicals are becoming more and more well-known these days because of their numerous therapeutic applications. In the fight against various illnesses, including asthma, arthritis, and cancer, phytochemicals are essential. These phytochemicals have no negative side effects, in contrast to pharmaceutical compounds. These phytochemicals can also be referred to as "man-friendly medicines" because they treat illnesses without endangering people.

Gas Chromatography: Gas chromatography can be used to analyse volatile substances. Liquid phase is stationary while gaseous phase is flowing. When the molecules of the sample are in the liquid phase, they remain motionless. If a species distributes itself entirely in the fixed condition, it will not disperse. A sample will move at a medium pace if it distributes itself across both phases.

High Performance Liquid Chromatography: (HPLC): HPLC can be defined as an technique that mainly separates compounds on the basis of their interactions with solid particles within densely packed column and also the solvent used in the mobile phase. In order to elute the analytes through the column, high pressures up to 400 bars are necessary prior to the reach to detector. HPLC is particularly valuable for the analyses of compounds that cannot be vaporized or decompose at high temperatures.

High Performance Thin Layer Chromatography: (HPTLC): HPTLC can be defined as an advanced form of thin layer chromatography. A sorbent covering was previously added to these high-performance coatings that has a thickness ranging from 150 to 200 microns and a particle size of 5-7 microns. The decrease in particle size and layer thickness enhances the efficacy of the plate and improves the nature of separation.

Identification Of Major Bioactive Compounds [10]

The identification of major bioactive compounds in *Strobilanthes alternata* (*Hemigraphis alternata*) was conducted using various phytochemical tests. Carbohydrates were detected through Fehling's test, where a red or brick-colored precipitate indicated the presence of sugars. Fixed oils were confirmed by an oil stain on filter paper. Alkaloids were identified by heating the extract with hydrochloric acid, followed by Wagner's test, where a reddish-brown precipitate confirmed their presence. Flavonoids were detected using the alkaline reagent test, showing a yellow color that disappeared upon acid addition. Terpenoids were confirmed by the Horizon test, producing a yellow to crimson precipitate. Steroids were identified through the Salkowski test, where a red color formed in a chloroform-sulfuric acid mixture. Tannins were detected using ferric chloride, resulting in a greenish precipitate. Proteins and amino acids were confirmed by the Millon test, producing a white precipitate. Lastly, phenols were identified using the ferric chloride test, indicated by a dark green color change.

Correlation Between Traditional Uses And Bioactive Compounds

Human civilization has long employed natural goods, particularly those produced from plants, as

a source for a variety of therapeutic procedures. The most popular method for creating drugs from plants is careful examination of how ethnopharmacology of natural resources are used in human medicine across cultural boundaries. In mice, applying *H. alternata* (Blume) leaf paste to the wound encourages wound healing; however, oral dosing proved unsuccessful. By analysing the raw extracts of *H. alternata's* foliage and screening the anti-bacterial activity, the phytochemical elements of the plant were determined. The plant's ethanol, crude aqueous, contained coumarins, proteins, flavonoids, alkaloids, steroids, carbohydrates, phenols, saponins, and tannins. According to the aforementioned theories, H. alternata has therapeutic qualities and can be utilized to find bioactive natural compounds that could be the basis for the creation of novel medications that meet unmet therapeutic requirements. [3]

Phytochemical Variability

Influence Of Environmental Factors on Phytochemical Composition [11]

Climate change may jeopardize the concentration and character of these bioactive chemicals in medicinal plants by intensifying these environmental conditions. However, as a plant's defense mechanism, some climate change-related environmental stresses, such UV radiation or water scarcity, may promote the synthesis of particular phytochemicals. Additionally, some medicinal plants may become more bioactive as a result, which could improve their ability to treat illnesses. On the other hand, the same stressors might lower the levels of one or more of these bioactive substances, or they might alter their chemical makeup in a way that lowers the plant's efficiency or renders it totally dormant. For instance, variations in temperature and precipitation patterns may have an impact on the production of phytochemicals necessary for the pharmacological characteristics and therapeutic value of the plant.

Seasonal And Regional Variations In Phytoconstituents [12]

One of the many environmental factors influencing plant metabolite production is seasonal variation. Seasonal changes might cause the formation and storage of metabolites throughout time. Any plant material may undergo significant chemical changes as a result of these variances in metabolite production, which could impact the bioactive chemicals' value. Environmental elements like temperature, precipitation, soil, humidity, light intensity, and seasonal changes can all have an impact on plant growth. Additionally, the biological product is determined by its chemical composition, including its concentration, availability, and bioactivity. The validation and standardization of a plant's medicinal value may be routinely hampered by these alterations in its chemical profile. If a plant is inactive, its therapeutic value may be disregarded, however this assessment frequently ignores variables that affect phytochemical synthesis.

Pharmacological Activities (Table 1):

Table 1: Pharmacological Activities, Mechanisms, And Toxicity Profile of *Strobilanthes Alternata*

Pharmacological Activity	Methodology & Findings	Reference
Antioxidant Activity	**DPPH Radical Scavenging Activity**: 0.004% DPPH in methanol mixed with plant extract/ascorbic acid at various doses.	13

	Absorbance at 517 nm measured after 30 min, indicating antioxidant potential.	
Anti-inflammatory & Analgesic Effects	**In vitro**: Test extracts mixed with bovine albumin fraction, incubated, heated, and spectrophotometrically analyzed at 660 nm to determine protein denaturation inhibition. **In vivo**: Mice (20-24g) received propylene glycol (control), plant extract (250-500 mg/kg), or diclofenac. Carrageenan-induced paw inflammation measured with a plethysmometer. **Comparison with Standard Drugs**: Plant extracts at 200 and 400 mg/kg significantly reduced inflammation ($P < 0.05$). Xylene-induced edema test showed dose-dependent inhibition (20.12-35.15%).	14
Antimicrobial & Antifungal Properties	**Antibacterial Activity**: Extracts tested against pathogens (*E. coli*, *S. aureus*, *B. cereus*, *P. mirabilis*, *E. faecalis*, *Acinetobacter sp.*). Ethanolic extracts showed the highest inhibition zones (12-24 mm). **Potential Use in Treating Infections**: Presence of flavonoids, terpenoids, and saponins suggests antimicrobial, anti-inflammatory, and enzyme-inhibitory activities.	15,16
Other Pharmacological Effects	**Anticancer**: *H. alternata* extract inhibits cell division, affecting anaphase and metaphase, making it a potential anticancer agent. **Anti-inflammatory**: Extracts reduce phospholipase A2 activity, T-cell cytotoxicity, and PMN leukocyte migration in xylene-induced edema models. **Antidiarrheal**: Extracts decrease intestinal motility and secretion by inhibiting Na+/K+ ATPase activity, reducing peristaltic movement. **Anthelmintic**: Increased extract concentration correlated with higher paralysis and mortality rates in worms, similar to albendazole efficacy.	17-19
Toxicity & Safety Profile	**Acute & Chronic Toxicity Studies**: OECD guidelines followed. Mice received test extracts at different concentrations and were observed for 14 days. **Safe Dosage & Side Effects**: No mortality or toxicity at doses up to 4000 mg/kg. No behavioral or food intake changes observed.	1

Traditional Knowledge on Safety

Historical Safety Record in Traditional Use [20]

Often referred to as purple waffle plant, red flame ivy, or murikooti, Strobilanthes alternata belongs to Acanthaceae family. The leaves of this plant have long been used to treat wounds. To hasten the healing process of fresh cuts, apply the leaf extract. Steriods, phenols, Alkaloids, flavonoids, sugars, triterpenes, and amino acids are among the several phytoconstituents that Strobilanthes alternata is said to have. They have analgesic, antioxidant, anti-inflammatory and antibacterial properties.

Guidelines and precautions from traditional medicine [21]

Orthodox herbal remedies which are considered "acceptable or safe, but does not have a recognized level of efficacy" fall under "traditional herbal medicine products" in the EU, where non-clinical and clinical study standards are low stringent. For registration reasons, a comparable pharmacological category known as "traditional phytotherapeutic products" is defined in a regulatory proposal released by the Brazilian National Health Surveillance (Anvisa). Both organizations appear to be lax when it comes to proving the effectiveness of herbal medications, taking traditional usage as proof of safety and a

way to avoid a comprehensive toxicological analysis.

Pharmaceutical Applications

Formulation and Development

Potential for developing pharmaceutical products [9]

Herbal capsules: On comparing herbal capsule formulations and aqueous preparations like decoctions and infusions, the stability of herbal capsule is comparatively superior. It is necessary to ascertain the stability and shelf life of capsule preparations in order to give suitable storage directions. In a range of long-term storage settings, herbal capsules containing pellets demonstrated a consistent and steady release of phenolic components, suggesting that the process used to prepare dry herbal extracts influences the active components' stability.

Herbal ointments: Ointments are generally oily, semi-solid formulations that are applied to the rectum, nasal mucosa or skin. Base of the herbal ointments often contains one or more plant materials that have been extracted or finely sifted. Deep wounds shouldn't be treated with herbal ointments. The stability of ointments is comparatively higher than that of other liquid dosage forms.

Challenges in Drug Development

Issues related to bioavailability, stability, and standardization [22]

Insufficient standardization and lack of quality specifications- The fact that herbal medications are used is one crucial truth. The fact that an herbal medicine is used for its holistic benefits is one crucial feature. A variety of chemical components with intricate molecular formulas are included in every botanical ingredient used in the herbal preparation. Every single herbal preparation has inherent polypharmacy. As a result, standardizing the ingredients or production of herbal remedies becomes a very difficult problem.

Current Marketed Products

Overview of existing commercial products derived from *Strobilanthes alternata* [6]

Vranaropani Malahara: This preparation has been altered and does not draw from any classical sources. The processes followed Malahara Kalpana6's guidelines. The ratio followed was 1:6. To Vranaropani Taila, little chunks of bee's wax was slowly added and mixed carefully. The preparation was done in a fire of moderate intensity. Once the wax has completely dissolved, use a clean towel to filter the mixture. Later, the tubes were filled with the Malahara.

Vranaropani Taila: The preparation was done in accordance with Taila Kalpana's traditional references. The same substance was used to make 4,5 Kalka (raw drug paste) and Swarasa (fresh leaf extract). In the preparation, coconut oil was utilized as Sneha Dravya. The preparation was done with frequent stirring and a moderate fire intensity till Taila Paka Sidhi Lak-shana was achieved. A fresh cloth that had been previously stored in an airtight container was used to filter it further.

Conservation and Sustainability

Current conservation status and threats to the plant's survival [23]

Numerous human activities, such as overgrazing, habitat destruction, premature harvesting, and overharvesting, increase the risks for medicinal plants in mountainous areas and pose danger to their populations. Medicinal plants are also under

risk from a number of environmental variables, including habitat fragmentation, soil degradation, and variations in temperature and precipitation.

Sustainable Harvesting Practices

Recommendations for sustainable use and conservation [24]

Conservation strategies Sources of herbs from indigenous populations are being collected in greater quantities. throughout the real world, the need for natural resources has grown by 8–15% a year throughout North America, Europe, and Asia. Below a given threshold, a species' capacity to reproduce is irreparably reduced. Many sets of instructions, including those that include both in vivo and outside conservation, have been developed for the protection of plants for medicinal purposes. Techniques for preservation More and more assets for medicinal plants are being gathered, mostly from wild populations. In fact, during the past few years, the need for resources from nature has grown by 8–15% throughout Europe, North America, and Asia. The ability of a species to produce offspring is permanently diminished below a certain level. For the preservation of plants for medicinal purposes, numerous sets of guidelines have been produced, including ones which cover the use of both vivo and external conservation.

Role of Cultivation

Potential for cultivation to meet demand and conserve wild populations [5]

1. Propagation: *Hemigraphis alternata* can be conserved through cuttings or division. Choose a robust stem for cuttings, administer a rooting hormone, and Plant in a medium that drains properly. As an alternative, the plant parts can be separated into various sections for replanting, ensuring that each section has an adequate number of stems and a strong root system.
2. Planting Medium: A light, well-drained soil mixture is ideal for this plant. To enhance soil aeration and drainage and help avoid issues like root rot, mix normal potting soil with perlite or coarse sand.
3. Watering Make sure the soil is consistently moist, but avoid overwatering. Before watering again, wait until the top layer of soil has somewhat dried. It's crucial to modify the frequency of watering in colder climates to account for the decreased rate of plant growth.
4. Light requirements: Bright indirect light is preferred for *Hemigraphis alternata*. Full sun or some shade is ideal because direct sunlight can harm the foliage. 5. Temperature and Humidity: 15°C to 24°C is the best temperature range for this plant. Maintaining it in a moist environment or using a humidity tray will aid in its growth because it thrives on high humidity.
5. Fertilisation: Throughout the growing season, which typically consists of spring and summer, fertilise every four to six weeks with a balanced water-soluble fertiliser. Apply fertiliser sparingly during the autumn and winter months when plant growth slows down.
6. Trimming: Consistent trimming encourages denser growth and helps shape the plant. For a more compact, lush look, trim back excessively long stems and remove any dead or discoloured leaves.

Future Directions

Herbal remedies combine the various therapeutic experiences of many past generations with the practices of indigenous medical systems. which provides helpful advice on how to choose, prepare, and use herbal formulations for the management, control, treatment of variety of ailments. The hunt

for novel therapeutic compounds from medicinal plants is still ongoing. Around $100 billion is shared by the herbal business globally, and it has good room to grow. Over the past 20 years, both industrialized and developing nations have increased their research efforts to authenticate and scientifically assess herbal medications through clinical trials. Therefore, in light of the more promising future of herbal medicines, we made an effort to thoroughly examine the state of their application in the treatment of a range of illnesses and related pharmacological problems. Additionally, the need for more research into creating herbal drugs as contemporary therapeutic agents is discussed.[25]

Potential for New Therapeutic Applications

Emerging trends and possible future applications [26]

A long-standing principle of traditional medicine is the use of food as medication. Newer uses of current medications are undergoing research, such as their potential to treat depression and cognitive impairment in Alzheimer's disease, which are major social and financial burdens due to the world's growing senior population. various studies have been done on the potential of herbal supplements to mitigate the negative side effects of modern medical therapies including chemotherapy and radiation therapy. Future uses may even involve reducing the adverse physiological and psychological effects astronauts endure while in space. Studies have indicated that certain Chinese herbs may be helpful in reducing stress in animal models created in a space simulation by acting on multiple targets through multiple pathways.

Integration with Modern Medicine

Opportunities for integrating Strobilanthes alternata into contemporary healthcare [27]

The leaves are used in treating gallstones and also wounds. In Java, leaves are mainly used in treating hemorrhoids and diarrhea. Leafy mixture is being used to alleviate heavy periods. applied externally to skin issues. Leaf paste is applied to recently cut wounds to encourage healing and halt bleeding; it is also used to treat anemia. To induce sterility and as a form of contraception, the buds of leaf were pressed in water and consumed for almost four days.

CONCLUSION

In conclusion, *Strobilanthes alternata* is a valuable medicinal plant with diverse pharmacological properties, including antibacterial, anti-inflammatory, antioxidant, and wound-healing effects. Its traditional use in treating wounds, ulcers, infections, and other ailments is supported by its rich phytochemical composition, including alkaloids, flavonoids, terpenoids, and saponins. While preliminary research highlights its therapeutic potential, further pharmacological and clinical studies are essential to fully understand its active compounds, mechanisms of action, and long-term safety. Integrating traditional knowledge with scientific validation may lead to the development of novel treatments, making this plant a promising candidate for future medicinal applications.

ACKNOWLEDGMENT

We acknowledge the various knowledge databases and scientific sources utilized in compiling this chapter.

Conflict Of Interest

The authors claim no conflict of interest

Funding

Not Applicable.

REFERENCES

1. Mushiur Rahman SM, Atikullah M, Islam MN, Mohaimenul M, Foysal A, et al. Anti-inflammatory, antinociceptive and antidiarrhoeal activities of methanol and ethyl acetate extract of Hemigraphis alternata leaves in mice. Clin Phyto. 2019 Dec;5(1):1-11. doi: 10.1186/s40816-019-0110-6.
2. Devasahayam AB, Palollathil A, Kumar ST, Jaikanth C, Shubham SU, Sakshi SP et al. Role of Hemigraphis alternata in wound healing: metabolomic profiling and molecular insights into mechanisms. Sci Rep.2024; 14: 3872.
3. Rangheetha R, Suganya M, Sridharan K, Sureshkumar M, Vivekanandhan G, Kalaiselvi M, Bhuvaneshwari V, Amsaveni R. Evaluation of phytochemical constituents of Hemigraphis alternata (Burm. F.) T. Anderson leaf extract. Der Pharmacia Lettre. 2016;8(6):335-38.
4. Rojas-Sandoval J. Hemigraphis alternata (red ivy). CABI Compendium. 2017 Jan 11. doi: 10.1079/cabicompendium.121880
5. Gowthaman S, Ilango KB, Brindha R, Bharathi S, Paulraj WW, Aju NT, et al. A comprehensive review of Hemigraphis alternata. Int J Pharm Res Appl 2024;9:576-587.
6. Arsha KcccP, Y S, Padyana S. Pharmaceutical preparation of Vranaropani Malahara and its analytical evaluation. Int Ayurvedic Med J 2020;8(4):2296. doi: 10.46607/iamj.p04042020.
7. Mohan S, George J, Parameswari K, Dinesh MD. A short review on traditional wound healer - Hemigraphis colorata. Int J Eng Sci Invent 2017;6(11):56-57. ISSN: 2319-6734 (Online), 2319-6726
8. Rangheetha R, Suganya M, Sridharan K, Sureshkumar M, Vivekanandhan G, Kalaiselvi M, Bhuvaneshwari V, Amsaveni R. Evaluation of phytochemical constituents of Hemigraphis alternata (Burm. F.) T. Anderson leaf extract. Der Pharmacia Lettre. 2016;8(6):335-38.
9. Kumadoh D, Ofori-Kwakye K. Dosage forms of herbal medicinal products and their stability considerations - an overview. J Crit Rev 2017;4:1-8.
10. Banu KS, Cathrine L. General techniques involved in phytochemical analysis. Int J Adv Res Chem Sci. 2015 Apr;2(4):25-32.
11. Alum EU. Climate change and its impact on the bioactive compound profile of medicinal plants: implications for global health. Plant Signal Behav. 2024;19(1):2419683. doi: 10.1080/15592324.2024.2419683.
12. Tlhapi D, Ramaite I, Anokwuru C, van Ree T, Madala N, Hoppe H. Effects of seasonal variation on phytochemicals contributing to the antimalarial and antitrypanosomal activities of Breonadia salicina using a metabolomic approach. [Internet]. 2024 Jan 30 [cited];10(2):e24068.
13. Nasrin KS, Joseph S. Evaluation of antibacterial and antioxidant activity of Hemigraphis colorata (Blume) H.G Hallier. YMER 2022;21(5):1355.
14. Adangampurath S, Sudhakaran S. Anti-inflammatory potential of flavonoids from Hemigraphis colorata. Int J Life Sci 2018;6(2):569-574
15. Anitha VT, Marimuthu J, Jeeva S. Anti-bacterial studies on Hemigraphis colorata (Blume) H.G. Hallier and Elephantopus scaber L. Asian Pac J Trop Med 2012;5:52-57.
16. Agneeswari S, Jansi M. Examination of phytochemicals, antioxidant and antibacterial activity of Hemigraphis alternata. Int J Eng Adv Technol 2019;9(1S6). ISSN: 2249-8958.

17. Hilal F. Cytotoxic effect of Hemigraphis alternata (Burm. F.) T. Anderson leaf extract on Allium cepa root tip. J Drug Deliv Ther 2019;9(3-s):459-462
18. Rahman SMM, Atikullah M, Islam MN, Mohaimenul M, Ahammad F, Islam MS, et al. Anti-inflammatory, antinociceptive and antidiarrhoeal activities of methanol and ethyl acetate extract of Hemigraphis alternata leaves in mice. Clin Phytosci 2019;5:16. doi: 10.1186/s40816-019-0110-6
19. Scariya S, Davis D, Hameed J, Anjusha MK, Babu M. An in-vitro evaluation on anthelmintic activity of different extracts of Hemigraphis colorata leaves. Res J Pharm Technol 2019;12(9):4394-4396. doi: 10.5958/0974-360X.2019.00755.8
20. Sainabi P, Meghna, Thashreefa PM, Krishna TS, Devy DKV. Formulation and evaluation of polyherbal wound healing ointment using Chromolaena odorata, Coleus amboinicus, Strobilanthes alternata and Solanum melongena. Int J Pharm Sci 2024;2(9):130.
21. Moreira DdL, Teixeira SST, Monteiro MHD, De-Oliveira ACAX, Paumgartten FJR. Traditional use and safety of herbal medicines. J Ethnopharmacol 2014;152:248-257.
22. Middha A, Bhardwaj S, Kataria S. Standardization of medicinal plant materials. Int J Res Ayurveda Pharm 2011;2(4):1100-1109.
23. Khakurel D, Uprety Y, Karki S, Khadka B, Poudel BD, Ahn G, et al. Assessing the risks to valuable medicinal plants in Nepal from human activities and environmental factors. J Ethnopharmacol 2024;51:e02860.
24. Chen SL, Yu H, Luo HM, Wu Q, Li CF, Steinmetz A. Conservation and sustainable use of medicinal plants: problems, progress, and prospects. Chin Med 2016;11:37. doi: 10.1186/s13020-016-0108-7.
25. Khan MSA, Ahmad I. Herbal medicine: current trends and future prospects. In: New Look to Phytomedicine Advancements in Herbal Products as Novel Drug Leads. 2019. p. 3-13.
26. Williamson EM, Liu X, Izzo AA. Trends in use, pharmacology, and clinical applications of emerging herbal nutraceuticals. Br J Pharmacol 2020;177:1227-1240.
27. Dhanya Rajan EP, Parvathi Pushparaj, Sauganth S, Sreesha KK, Vaishnavi K. Standardisation and evaluation of phytochemicals from the aerial parts of strobilanthus alternata. EJBPS. 2023; Volume 10, Issue 3: 119-25.

HOW TO CITE: S. K. Sherlin*, Deepak Kumar Jha, Exploring the Ethnobotanical and Phytopharmacological Profile of Strobilanthes Alternata: A Comprehensive Review, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 4, 359-371 https://doi.org/10.5281/zenodo.15129065