International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 12 Issue 10, October-2023, Impact Factor: 7.957

Ethnomedicinal, Pharmacological and Therapeutic Potential of *Viola serpens*: A Review

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ABSTRACT

***Viola serpens*, commonly known as "banafsha," is a perennial evergreen herb belonging to the Violaceae family. It typically reaches a height of around 10 centimeters and blooms in late winter, showcasing charming, fragrant, deep violet, nodding flowers. This herb can be found in the Kashmir and western Himalayan regions, particularly at altitudes ranging from 1500 to 1800 meters. Renowned for its therapeutic significance in both Ayurvedic and Unani medicinal systems, *Viola serpens* serves as a valuable resource for treating various ailments, notably whooping cough.In addition to its anti-inflammatory, diaphoretic, diuretic, emollient, expectorant, antipyretic, and laxative properties, *Viola serpens* contains salicylic acid, a compound used in the production of aspirin. This feature makes it highly effective in addressing issues such as headaches, migraines, and insomnia.The objective of this article is to compile and document comprehensive information on *Viola serpens* pharmacological attributes. It also underscores the pressing need for further research and development in harnessing its full potential.**

Keywords: Ethnobotany, Medicinal plant, Pharmaceutical, Traditional, *Viola serpens*.

INTRODUCTION

Throughout history, humanity has consistently turned to the natural world to fulfill their fundamental requirements, whether it be for food production, constructing shelters, making clothing, crafting transportation methods, creating fertilizers, enhancing flavors and fragrances, or, notably, developing medicines [1]. Traditional medicine systems, deeply rooted in the use of plants, have been in practice for millennia and remain a source of novel remedies.

The majority of the global population still heavily depends on traditional medicinal plants and other natural resources for their daily healthcare needs. It is worth noting that a significant portion of medical prescriptions—about one-quarter—involve formulations derived from plants or plant-based synthetic equivalents. According to the World Health Organization (WHO), a striking 80% of the world's population, particularly those in developing regions, relies on plant-derived medicines to meet their healthcare requirements [2].

Individuals who turn to traditional remedies may not necessarily grasp the scientific underpinnings of these treatments. Nonetheless, they rely on personal experiences that demonstrate the effectiveness of certain medicinal plants when used at appropriate therapeutic dosages. With our improved understanding of human physiology today, we are better equipped to fathom the therapeutic potential of plants and their multifaceted role in addressing complex health conditions [3].

Medicinal plants typically contain a blend of various chemical compounds that can function independently, cumulatively, or synergistically to promote well-being. For instance, a single plant might encompass bitter compounds that aid digestion, anti-inflammatory agents that reduce inflammation and pain, phenolic compounds serving as antioxidants and venotonics, tannins with antibacterial and antifungal properties acting as natural antibiotics, diuretic substances aiding in waste product and toxin elimination, and alkaloids contributing to mood enhancement and a sense of well-being [4].

Among the most ancient medicinal traditions, Ayurveda likely predates traditional Chinese medicine and is regarded as the origin of structured medical systems. Ayurveda offers a holistic and practical framework for maintaining equilibrium and harmony within the body. The term "Ayurveda" originates from the Indian words "Ayar" (Life) and "Veda" (Knowledge or Science), signifying the "Science of Life"[5].

Ethnobotany and Ethnopharmacology are interdisciplinary fields that focus on the practical wisdom of indigenous communities regarding medicinal substances, their potential health benefits, and associated health risks [6]. It's evident that many pharmaceuticals and phyto medicines derived from plants currently in use have roots in the traditional knowledge of native populations across the globe. Some of this wisdom has been formally documented, studied, and subjected to scientific scrutiny. It's worth noting that, among the vast array of plant species, only a fraction has been explored within the confines of a laboratory.

Viola serpens serves as a prime example of the value of plants traditionally employed by local communities. Various Viola species are found in the temperate Himalayas, reaching altitudes of up to 2000 meters [7]. In India, *Viola serpens* can be found in several states. It has a wide range of applications, including the treatment of respiratory congestion, asthma, sore throat, colds, coryza, and throat cancer. Additionally, it proves beneficial for issues such as bleeding piles, constipation, fever, headache, and skin conditions. In the Unani system of medicine, it forms a key component of "Joshanda," a concoction primarily used to address coughs and colds [8].

Given the significance of this medicinal plant, this review aims to provide comprehensive information on traditional and local knowledge, as well as ethnobotanical and ethnomedical aspects. It also delves into the identification of pharmacologically important compounds and offers insights from biochemical and pharmacological studies conducted on this valuable plant.

MORPHOLOGICAL FEATURES

The Violaceae family, also known as Alsodeiacae, Leoniaceae, or Retrosepalaceae, consists of around 800 species distributed across twenty genera, as documented by Mabberley in 1987 [9]. Members of this plant family are characterized by their perennial herbaceous or shrub-like nature and typically bear simple, palmately or deeply dissected leaves. Their flowers can be bisexual, displaying either zygomorphic or actinomorphic traits, featuring a calyx with five parts, a corolla composed of five petals, with one of them being notably large and spurred. The androecium typically comprises five stamens, while the gynoecium consists of a compound pistil formed by the union of three carpels, with superior ovules, and the fruit is in the form of a capsule [10]. Violaceae can be found in their natural habitats across various countries, including India, Nepal, Sri Lanka, China, Malaysia, Pakistan, and Australia [11].

Taxonomical Classification:

Kingdom	Plantae
Clade	Tracheophytes
Clade	Angiosperms
Clade	Eudicots
Clade	Rosids
Order	Malpighiales
Family	Violaceae
Subfamily	Violoideae
Tribe	Violeae

FLORAL CHARACTERISTICS

The flowers are carried on elongated, slender stalks known as scapes, which extend beyond the leaves. These flowers exhibit colors ranging from lilac, blue, white, to purple, and they blossom on the main stem. The larger ones measure approximately 6 to 12 mm in diameter, while the tiny flowers emerging from the axils of the cauline leaves are minuscule. The cleistogamous, or underground, flowers have a diameter of only about 1 mm. The fruit takes the form of a spherical capsule with a few seeds. Flowering typically occurs in February to March, followed by fruiting in April to May [12].

PHYTOCHEMICAL STUDIES

Viola serpens roots comprise components such as glucoside (specifically methyl salicylate) (Fig. 1), an alkaloid referred to as voiline, and a glycoside known as viola quercitrin (Fig. 2) [13]. Meanwhile, the entire *Viola serpens* plant contains a combination of constituents, including glycoside methyl salicylate, viola quercitrin, alkaloid voiline, as well as gum, mucilage, sugar, and saponin [14].

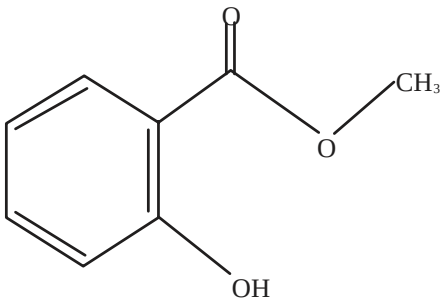

Fig. 1: Methyl salicylate

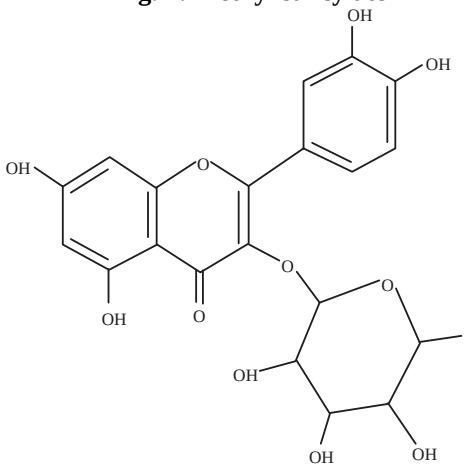

Fig. 2: Quercitrin

The *Viola* plant boasts a wealth of secondary metabolites, which encompass flavonoids, alkaloids (specifically, violin and viola quercitin), and essential oils like ionones, α-ionone, β-ionone, β-dihydroionone, hydroquinone dimethyl ether, and linolenic. These compounds are extensively utilized for their diuretic, anti-inflammatory, purgative, and medicinal properties, addressing concerns such as abdominal pain, skin disorders, and upper respiratory issues like cough, sore throat, and irritation[15] [16]. Additionally, Abbasi et al. (2009) [17] identified *Viola serpens* as containing a combination of glycoside methyl salicylate, quercitrin, the alkaloid voiline, along with gum, mucilage, sugar, and saponin.

ETHNOMEDICINAL USES

The entire *Viola serpens* plant is endowed with a wide range of medicinal properties. It acts as an aperient, antiseptic, antipyretic, cooling agent, demulcent, diaphoretic, diuretic, emetic, emollient, expectorant, febrifuge, and purgative. *Viola serpens*, as a whole, stands out as one of the most valuable medicinal plants, serving as an antipyretic, demulcent, diaphoretic, and diuretic remedy. It finds application in the treatment of conditions such as asthma, bleeding piles, throat cancer, constipation, cough, fever, skin disorders, and headaches[18].

PHARMACOLOGICAL ACTIVITY AND THERAPEUTIC POTENTIAL OF *VIOLA SERPENS*

Viola serpens holds substantial promise for treating a wide range of ailments, primarily attributed to the diverse pharmacological properties of its phytochemicals. Multiple studies have documented the plant's capacity to exhibit various pharmacological activities, including anti-inflammatory, analgesic, antidiabetic, hepatoprotective, gastroprotective, anti-ulcer, anti-urolithic, antimicrobial, antitumor, antileishmanial, and wound-healing effects (Table

1). These findings regarding the pharmacological attributes of *Viola serpens* underscore its potential for effectively addressing a variety of diseases and disorders.

Anti-inflammatory activity
A study was conducted to assess the in vivo anti-inflammatory effects and acute toxicity of both the crude methanol extract of *Viola serpens* and its different fractions [19]. The results from the acute toxicity test indicated that a dosage of 2 g/kg was well-tolerated and safe.

Antioxidant activity
Several studies were conducted to assess the antioxidant properties of *Viola serpens*, with one of them focusing on its potential as a source of natural dietary antioxidants [20]. This particular study aimed to explore its ability to scavenge superoxide anion radicals and its capacity to act as a reducing agent, utilizing Berry's anthocyanin extract. When analyzing the ethanolic extract of the plant, the research unveiled the presence of both enzymatic antioxidants, including catalase, peroxidase, and ascorbate oxidase, and non-enzymatic antioxidants like ascorbic acid. Notably, the findings indicated that *Viola serpens* displayed a higher level of medicinal value, with an antioxidant capacity of 0.40 units per milligram of protein [21].

Headache and insomnia
It has the potential to aid in alleviating conditions such as headaches, sleeplessness, vertigo, and fatigue [22].

Bronchitis and cough
The entire upper portion of the plant, encompassing the stem, flowers, and leaves, is employed in the treatment of bronchitis, cough, and sneezing [23-24].

Table 1: Therapeutic Potential of *V. serpens* Across Various Diseases

Pharmacological Activity	Reference/s
Anti-inflammatory	[19]
Antinociceptive Activity	[25]
Antioxidant, Antibacterial, Antifungal and Acute toxicity capacity	[26,20,21]
Antimicrobial activity	[20]
Nephroprotective effect	[28]
Antipyretic activity	[30]
Antibacterial activity	[27]
Antinociceptive activity	[29]

Antinociceptive Activity
The crude extract and various fractions of *V. serpens* exhibited pronounced antinociceptive properties, suggesting its safety and validating its traditional use as an analgesic [25]. The study aimed to assess the toxicity and antinociceptive effects of *Viola serpens* crude extract and its fractions in animal experiments. The results indicated complete safety of the extract up to doses of 2 g/kg in acute toxicity testing. Moreover, in the acetic acid-induced writhing test, the extract significantly ($p < 0.05$) alleviated painful sensations at doses of 100, 200, and 300 mg/kg.

Antibacterial andAntifungal activity
The pure oil extracted from *Viola serpens* has demonstrated its highest efficacy in combatting Bacillus subtilis, exhibiting a robust inhibition zone measuring 20.0±0.16 mm in diameter, along with a minimal inhibitory concentration (MIC) of 200 µL/mL[26]. In the current context, there exists an urgent imperative to unearth novel antimicrobial agents for therapeutic purposes, given the escalating severity and prevalence of drug resistance over time. This research endeavor was dedicated to identifying natural compounds within *Viola serpens* leaf extracts to unveil their antibacterial potential against pathogens associated with jaundice. The outcomes underscore the effectiveness of *Viola serpens* in this regard [20].Pratik Adhikary [2011] [27] also delved into exploring the antimicrobial properties of *Viola serpens* from the Dhunkharka Community in Kavrepalanchowk, Nepal, revealing significant antimicrobial potential.

Nephroprotective effect

A study was designed to investigate the potential nephroprotective properties of *Viola serpens* Wall's crude extract and its various fractions in the context of paracetamol-induced toxicity in rabbits [28]. Notably, all the fractions, along with the crude extract, exhibited a significant impact on serum creatinine levels. Furthermore, when it came to the influence on urine urea, the n-hexane, ethyl acetate, n-butanol, and aqueous fractions at higher doses (300 mg/kg b.wt.), as well as the crude extract and chloroform at lower doses (150 mg/kg b.wt.), displayed remarkably effective outcomes comparable to the effects of silymarin. The creatinine clearance results indicated high significance for all the fractions, except for chloroform and aqueous at 300 mg/kg, as well as the hydro-methanolic extracts at both doses.

Antinociceptive effect

The primary objective of this study was to assess the toxicity and analgesic impact of the crude extract and fractions derived from *Viola serpens* through animal experiments [29]. Importantly, the extract exhibited complete safety even at doses as high as 2 g/kg in the acute toxicity assessment. In the acetic acid-induced writhing test, the extract induced a significant ($p < 0.05$) reduction in pain perception at doses of 100, 200, and 300 mg/kg. Following fractionation, the hexane fraction emerged as the most effective in alleviating pain, followed by the chloroform and ethyl acetate fractions in a dose-dependent manner. Overall, both the crude extract and its fractions from *V. serpens* demonstrated notable analgesic effects and appeared to be a safe treatment option, thereby providing a scientific basis for its traditional use as an analgesic.

CONCLUSION

The review article at hand has determined that *Viola serpens* contains a diverse range of phytoconstituents and various phytocomponents that underlie its various pharmacological effects. Nevertheless, further research is warranted to delve into the precise mechanisms through which medicinal plants with different therapeutic properties operate. Future endeavors should aim to isolate these compounds and establish pharmacological agents derived from natural sources, paving the way for the treatment of a multitude of diseases.

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