

A COMPREHENSIVE REVIEW ON THE PHYTOCHEMISTRY, ETHNOPHARMACOLOGY, AND PHARMACOLOGICAL POTENTIAL OF EVOLVULUS NUMMULARIUS

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Article Received on 27 July 2026,
Article Revised on 17 August 2026,
Article Published on 01 Sept. 2026,

<https://doi.org/10.5281/zenodo.22157087>

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How to cite this Article: Abdul Malik, Prateek Kumar, Dr. (Professor) Anurag Kumar. (2026). A Comprehensive Review on The Phytochemistry, Ethnopharmacology, and Pharmacological Potential of Evolvulus Nummularius. World Journal of Pharmaceutical Research, 15(17), 119-129.

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ABSTRACT

Evolvulus nummularius (L.) A perennial, creeping herb, L. is a member of the family Convolvulaceae and is widely distributed throughout tropical and subtropical areas. It has been traditionally used for the treatment of wounds, inflammation, fever, gastrointestinal disorders, skin infections, helminthic infestation and other ailments for a long time. In recent years, phytochemical studies have revealed the presence of several bioactive compounds including flavonoids, phenolic compounds, alkaloids, terpenoids, steroids, glycosides, tannins and saponins, which have been associated with its various biological effects. The ethnopharmacological significance of *E. nummularius* was established through experimental studies showing its antioxidant, anti-inflammatory, antimicrobial, wound healing, hepatoprotective and anthelmintic activities. There are also available toxicological studies that indicate a

favourable safety profile, although there are limited long-term toxicity and clinical investigations. The botanical details, ethnopharmacological uses, phytochemical constituents, pharmacological activities, toxicological studies and future research potential of *E. nummularius* are summarised. The evidence compiled demonstrates the therapeutic potential of this medicinal plant, and further phytochemical, pharmacological and clinical studies are needed to assist the development of this plant to a scientifically validated herbal therapeutic agent.

KEYWORDS: *Evolvulus nummularius*; Convolvulaceae; Medicinal plant; Ethnopharmacology; Phytochemistry.

1. INTRODUCTION

Medicinal plants have been used as a source of therapeutic agents for centuries and still play a great role in the modern era of drug discovery. The World Health Organization (WHO) estimates that a large percentage of the population in the world uses traditional herbal medicines for primary healthcare, which makes it important to scientifically validate the medicinal plants to ensure their phytochemical composition and efficacy, as well as their safety.^[1,2] *Evolvulus nummularius* (L.) L. is a perennial creeping herb of the Convolvulaceae family. It is widely distributed in tropical and subtropical countries including India, Sri Lanka, Southeast Asia and Africa. It has long been used in folk medicine for the treatment of fever, wounds, inflammation, gastrointestinal disorders and skin disease. Its traditional uses have led to scientific interest in the study of its phytochemical constituents and pharmacological properties.^[3,5] The phytochemical analysis has shown the presence of some bioactive compounds such as flavonoids, phenolics, terpenoids, steroids, glycosides, tannins and saponins, which are thought to be responsible for the various biological activities of the plant. Its ethnomedicinal importance has been reported in experimental studies, which demonstrate antioxidant, antimicrobial, anti-inflammatory, wound-healing, hepatoprotective, and other pharmacological properties.^[4,6] Although the results have been encouraging, the existing scientific data on *E. nummularius* is sparse. Hence, this review is intended to give a brief review of the botanical features, ethnopharmacological applications, phytochemical constituents, pharmacological activities and future research directions of *E. nummularius* to point out its potential as a valuable medicinal plant for further studies.

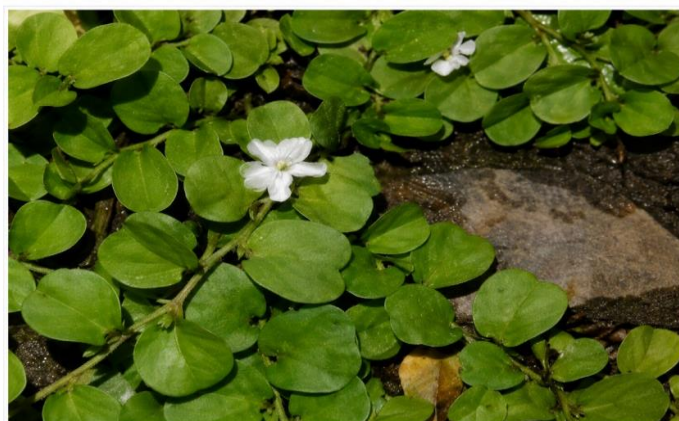


Figure 1. *Evolvulus nummularius* (L.) L. (Family: Convolvulaceae) – habit showing leaves and flower.

1.1. Botanical Profile of *Evolvulus nummularius*

Evolvulus nummularius (L.) L. is a perennial, creeping herb of the Convolvulaceae. It is a plant that can be found throughout the tropics and subtropics, and is known for its versatility and ability to withstand a variety of conditions. It has received much attention due to medicinal uses and the presence of biologically active phytoconstituents. The knowledge of its taxonomy, botany and geographical distribution is very important for proper identification, authentication and additional pharmacological and phytochemical studies.^[7]

1.1.1 Taxonomy

Evolvulus nummularius (L.) L. is also a member of the Morning Glory family (Convolvulaceae). *Evolvulus* includes 100 species primarily found in tropical and subtropical areas. The accepted taxonomy of *E. nummularius* is as shown below.^[7,9]

- **Kingdom:** Plantae
- **Division:** Magnoliophyta (Angiosperms)
- **Class:** Magnoliopsida (Dicotyledons)
- **Order:** Solanales
- **Family:** Convolvulaceae
- **Genus:** *Evolvulus*
- **Species:** *Evolvulus nummularius* (L.) L.

1.1.2 Botanical Description

Evolvulus nummularius is prostrate and creeping, a small perennial herb which forms dense mats on the ground. Stems are slender, branched, and appressed with nodes that have roots. Leaves simple, alternate, almost circular to broadly ovate, short-petiolate, finely hairy on both sides. The flowers are solitary, axillary and funnel-shaped, with pale blue to lavender petals. Fruit a small globose capsule with 1-4 smooth brown seeds. It spreads vegetatively and by seed and can spread rapidly under favourable environmental conditions.^[8,10]

1.1.3 Distribution and Habitat

E. nummularius is cosmopolitan in all tropical and subtropical parts of Asia, Africa, Australia and the Americas. It is widely distributed in open grasslands, cultivated fields, along roads, in lawns, waste lands and coastal plains in India. Grows in sandy or loamy soils and tolerates disturbed habitats in full sun. An ability to tolerate a variety of environmental conditions has undoubtedly facilitated its spread in a number of countries beyond its natural range.^[9,12]

2. Ethnopharmacological Importance

Evolvulus nummularius has a long history of traditional use in medicine and native healing practices in a number of tropical and sub-tropical areas. The plant has been used for medical purposes due to its versatility and is used in the treatment of various diseases such as wounds, skin diseases, inflammation, fever, gastrointestinal and helminthic infections. The versatility of traditional uses of *E. nummularius* has led to the study of its phytochemical constituents and pharmacological properties, many of which have corroborated traditional uses. Its ethnopharmacological value serves as an example of basis for the development of evidence-based herbal medicine and a motivation to continue research on therapeutic potential.^[13]

2.1 Traditional Uses

Evolvulus nummularius has been used traditionally in India and other tropical countries for treatment of several ailments. Various indigenous groups use it as medicine for wounds, skin infections, fever, inflammation, digestive ailments, helminthiases and urinary diseases. In various traditional medicine systems, the plant is also used for its antimicrobial and antioxidant activity, as well as for its general health-promoting effects. The ethnomedicinal uses have motivated research into its phytochemical makeup and pharmacological properties.^[13,16]

2.2 Parts Used and Mode of Administration

Medicinal use: Whole plant, leaves, stems and sometimes roots. Fresh leaves are often ground into a paste for topical applications to wounds, boils and skin diseases. The plant, or its aerial parts, are used to make decoctions or aqueous extracts and administered orally for treating common ailments, intestinal worm infestations and digestive disorders, as well as fever. The plant has been used alone or in combination with other medicinal plants for its medicinal properties.^[13,17]

3. Phytochemical Profile

Evolvulus nummularius is used for its medicinal properties due to some of its phytochemical composition. By phytochemical studies, the plant has been shown to contain different primary metabolites and secondary metabolites, many of which have biological activities with great potential. Many bioactive compounds have been identified through qualitative screening and advanced analytical methods that could be responsible for its antioxidant, anti-inflammatory, antimicrobial, wound healing and other pharmacological properties. The

characterization of these phytochemicals is crucial to understand the medicinal potential of *E. nummularius* and will aid in its development as a source of new therapeutic agents.^[18]

3.1 Major Phytoconstituents

Phytochemical studies of *Evolvulus nummularius* have revealed the presence of different primary and secondary metabolites. Phytochemical screening has been done in a preliminary manner with different solvent extracts, which revealed the presence of alkaloids, flavonoids, phenolic compounds, tannins, saponins, terpenoids, steroids, glycosides, carbohydrates, proteins and amino acids. These constituents are qualitatively and quantitatively different depending on the plant part, geographical location and extraction solvent used. It has been reported in both traditional and experimental studies that these phytochemicals are responsible for the broad spectrum of biological activities that are observed for the plant.^[18,20]

3.2 Bioactive Compounds

Several bioactive components have been identified in *E. nummularius* by using advanced analytical techniques like gas chromatography – mass spectrometry (GC – MS). Compounds reported include β -sitosterol, stigmasterol, ursolic acid, phytol, squalene, hexadecanoic acid (palmitic acid), linoleic acid derivatives, phytol acetate and other fatty acids and terpenoid derivatives. Some of these metabolites have confirmed antioxidant, anti-inflammatory, antimicrobial, hepatoprotective and wound healing activities, and may all play a role in the pharmacological activity of the plant. However, further phytochemical isolation and structural elucidation are necessary to pinpoint the main compounds responsible for its therapeutic activity.^[18,22]

4. Pharmacological Activities

Due to its wide range of pharmacological properties, mainly attributed to its rich phytochemical composition, *Evolvulus nummularius* has received much scientific interest. Extracts of the plant have been shown to have several biological activities, including anti-inflammatory, antioxidant, antimicrobial, therapeutic and wound healing. All the above pharmacological properties are consistent with its wide traditional applications and suggest its potential as a rich source of bioactive compounds in herbal therapeutics. *E. nummularius* has been reported to have the following major pharmaceutical activities.

4.1 Antioxidant Activity

The extracts of *Evolvulus nummularius* have been shown to have significant antioxidant properties in several studies. The methanolic and other solvent extracts possess good free radical scavenging activity in in vitro studies like DPPH and ABTS, which is mainly credited to the presence of flavonoids, phenolic compounds and other antioxidant phytochemicals. These constituents are effective in eliminating ROS and protecting against ROS-induced damage at the cellular level.^[23,25]

4.2 Anti-inflammatory Activity

Phenolic compounds, flavonoids, triterpenoids and phytosterols have been correlated with the anti-inflammatory activity of *E. nummularius*. These phytoconstituents appear to have anti-inflammatory activity in experimental studies, including the ability to inhibit inflammatory mediators and to decrease tissue inflammation. Detailed mechanistic studies are not available; however, the traditional use of the plant for inflammatory conditions shows that it has therapeutic potential.^[24,26]

4.3 Antimicrobial Activity

The extracts from *E. nummularius* have shown antimicrobial activity against some Gram-positive and Gram-negative bacteria. The methanolic extracts have been observed to be inhibitory against common pathogenic microorganisms, suggesting the presence of bioactive compounds with antibacterial properties. The antimicrobial activity is thought to be due to the synergistic effect of the flavonoids, tannins, terpenoids and other secondary metabolites found in the plant.^[23,25]

4.4 Wound Healing and Other Biological Activities

Traditionally, *E. nummularius* has been used for the treatment of wounds and skin disorders. Experimental evidence suggests that the plant promotes wound healing through its antioxidant, antimicrobial, and anti-inflammatory properties, which facilitate tissue repair and reduce the risk of infection. In addition to wound healing, the plant has also demonstrated anthelmintic, hepatoprotective, and other biological activities, indicating its broad pharmacological potential. However, further preclinical and clinical studies are required to establish its therapeutic efficacy and safety.^[24,26,27]

Table 1: Summary of the reported pharmacological activities of *Evolvulus nummularius*.

Pharmacological Activity	Plant Part / Extract	Experimental Model / Method	Major Findings	Reference
Antioxidant	Methanolic extract (aerial parts/leaves)	DPPH, ABTS, reducing power assays	Demonstrated significant free radical scavenging activity due to phenolics and flavonoids.	[23]
Anti-inflammatory	Methanolic extract	In vitro and experimental pharmacological studies	Reduced inflammatory responses, attributed to flavonoids, terpenoids, and phytosterols.	[24]
Antimicrobial	Methanolic extract	Agar well diffusion/disc diffusion against Gram-positive and Gram-negative bacteria	Showed appreciable antibacterial activity against selected pathogenic microorganisms.	[23,25]
Wound Healing	Whole plant/leaf extract	Experimental wound-healing models	Accelerated wound contraction and tissue regeneration through antioxidant and antimicrobial effects.	[24]
Anthelmintic	Methanolic extract	Experimental cestode model	Exhibited significant anthelmintic activity and parasite damage confirmed by microscopy.	[27]
Hepatoprotective	Methanolic leaf extract	Experimental NAFLD model	Improved liver biochemical parameters and reduced hepatic oxidative stress.	[30]

5. Toxicological Profile and Safety

Available toxicological data on *Evolvulus nummularius* is limited, but suggests good safety.

The acute toxicity test was registered in experimental animals, with the methanolic extract showing a relatively high margin of safety up to 2000 mg/kg orally.^[28,29] Additionally, the extract has been found to be less toxic when tested in vitro on normal cells, which corresponds to low toxicity in medicinal use.^[28] Subacute toxicity studies have also shown that there were no significant changes in body weight, haematological parameters, serum biochemical markers or histopathological architecture of major organs on the repeated administration of the extract. However, long-term toxicity, reproduction, genotoxicity and clinical safety studies remain to be done. For this reason, further well-designed studies are needed to confirm the safety and long-term therapeutic potential of *E. nummularius* in humans.^[28,30]

6. Future Perspectives

Evolvulus nummularius has gained more scientific attention recently due to its wide range of phytochemical composition and pharmacological properties, but there are still limited studies conducted. Future studies should emphasise the isolation and purification of bioactive compounds and structural studies of the compounds by using advanced analytical techniques.

Detailed mechanistic studies and standardisation of phytochemical profiling are also essential to define the relationship between individual phytochemicals and their biological activity.^[31,32] Moreover, well-done preclinical studies, extended toxicological research, pharmacokinetics studies and controlled clinical trials should be performed to establish the effectiveness and safety of *E. nummularius*. Standardisation of herbal formulations and the introduction of new drug delivery systems could render it an even more valuable therapeutic agent, and help to bring its use into the realm of evidence-based clinical practice.^[31,33]

7. CONCLUSION

Ethnomedically important plant *Evolvulus nummularius* has significant therapeutic potential due to its phytochemical composition and various medical properties. The reported antioxidant, anti-inflammatory, antimicrobial, wound healing and other biological activities are attributed to the presence of flavonoids, phenolic compounds, terpenoids, steroids, tannins and other bioactive constituents. It has been used traditionally in many ways, but the scientific evidence is limited and needs to be further substantiated. *E. nummularius* as a whole is a valuable source of bioactive natural products for the future of drug discovery. To define its therapeutic uses, efficacy, and safety, more in-depth phytochemical research is required, along with standardised pharmacological studies and detailed toxicological assessments, as well as well-designed clinical trials. Future studies are needed to fill this gap in traditional knowledge and evidence-based medicine, thus further improving the medicinal potential of this plant.^[34,36]

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