



# A COMPLETE ANALYSIS OF THERAPEUTIC AND PHARMACOLOGICAL RELEVANCE OF *ACALYPHA INDICA*

<sup>1</sup>Jenifer Nadar, <sup>2</sup>Pradnyesh Rane, <sup>1</sup>Dr. Rasika Pawar\*

<sup>1</sup>Department of Microbiology, <sup>2</sup>JSA, MPCB Project. \*Corresponding author  
Smt. Chandibai Himathmal Mansukhani College, Thane, India.

**Abstract:** Traditionally used in South and Southeast Asia, a medicinal plant of the Euphorbiaceae family, *Acalypha indica* L. (usually known as Indian nettle, Kuppaimeni in Tamil, and Kuppamaniya in Sinhala) is an upright herbaceous weed with great ethno-medicine value and a rich phytochemical profile with excellent levels of alkaloids, flavonoids, tannins, saponins, glycosides, steroids, and phenolic compounds. GC-MS and RP-HPLC have uncovered active components, that includes gallic acid, naringenin, phytol, squalene, and coumarins, further supporting its therapeutic effects. It has broad spectrum of biological characteristics including antibacterial, antifungal, anti-inflammatory, antioxidant, wound healing, antiulcer, anti-diabetic, anti-asthmatic, anti-malarial, anti-fertility, diuretic, anthelmintic, anti-psoriatic, anti-venom, and anti-viral properties. With leaves being the richest source of active phytochemicals, extracts from various plant components demonstrate significant activity against microbial pathogens, oxidative stress, inflammation, and chronic ailments. Together, conventional uses and scientific evidence support *Acalypha indica* as a prospective herbal candidate for drug research and treatments.

**Keywords:** medicinal plants, phytochemicals, Indian nettle, *Acalypha indica*, pharmacological activities.

## I. INTRODUCTION

Commonly known as Indian Nettle in English, Kuppaimeni in Tamil, Kuppamaniya in Sinhala, its leaves are used locally as a herbal medicine (Sivageethan et al., 2022). *Acalypha indica* belongs to the Euphorbiaceae family and is regarded as an herbal remedy in South and Southeast Asia (Maddumabandara et al., 2024). The genus comprises around 450–500 species and is a notable group of plants with both ecological and medicinal significance (Labu et al., 2025). *A. indica* is a prevalent weed in tropical and subtropical zones, especially along the equatorial line, and its natural range comprises South Africa, India, Sri Lanka, Yemen, and Pakistan (Sahukari et al., 2021).

## II. MORPHOLOGY

Rising 50 to 75 centimetres, *Acalypha indica* is an erect, herbaceous plant with slender, pubescent branches. The leaves are ovate, 2–6 cm long, with serrated borders and long petioles up to 7 cm. Axillary spikes grow up to 7 cm long make up inflorescences. Male blossoms above and female flowers are present at the base; campanulate bracts and shortly dentate; the anthers are vermiculiform. The ovary is hispid with two. One of these is often sterile; the fruit is a little, smooth, light brown, one-seeded capsule around 1–2 mm long (Saranya et al., 2022).



Figure 1: From Mohan et al .2012



Figure2: From Sahukari et al.2025

### III. Taxonomic Details

Kingdom: Plantae  
 Class: Angiosperms  
 Order: Malpighiales  
 Family: Euphorbiaceae  
 Subtribe: Acalyphinae  
 Genus: Acalypha  
 Species: Indica (Saranya et al., 2022).

### IV. FUNCTION IN ANCIENT MEDICINE

Conventional medicine often makes use of *Acalypha* species to cure respiratory issues, diabetes, dysentery, skin diseases, intestinal worms, bronchitis, asthma, and pneumonia. Commonly, *Acalypha indica* is used as a diuretic and for treating respiratory problems. It is also used as poultices, decoctions, or infusions to treat wounds, fever, and other symptoms of the gastrointestinal system (Labu et al., 2025). The leaves possess anti-inflammatory and antioxidant capabilities. These are beneficial for inflammatory diseases as well as arthritis. Stems have analgesic properties used to treat musculoskeletal pain. Roots contain polyphenols helpful against oxidative damage, antioxidants, antibacterial, and anticancer capabilities, degenerative illnesses, infections, and stress (Ajai et al., 2023).

### V. ACALYPHA INDICA'S PHYTOCHEMICAL PROFILE

The medicinal qualities of *Acalypha indica* are linked to its great phytochemical composition. Composition includes a range of bioactive molecules that help its conventional and proven medical benefits supported by research. Biologically active compounds in *Acalypha indica* including components such as flavonoids, alkaloids, saponins and tannins are important in its therapeutic potential (Pharmacological Properties and Therapeutic Applications of *Acalypha indica*, 2025). Phytochemical screening of the methanolic leaf extract of *Acalypha indica* confirmed presence of alkaloids, tannins, steroids, saponins, flavonoids, glycosides, phenolics. Thirty different phytochemical constituents were found by GC-MS analysis of compounds (Rajkumar et al., 2022). Most phenols, flavonoids, and tannins were found in *Acalypha indica* leaves. Alkaloids and saponins were similar to those found in the roots and stems. The most abundant source of phytochemical was leaves (Tasmim et al., 2021).

Gallic acid was found at higher levels (119.7 mg/kg) in RP-HPLC analysis of *Acalypha indica* leaves. Other chemicals, including caffeic acid, ferulic acid, rutin, and coumarins were also found (Murugan & Selvam, 2015). *Acalypha indica* has a range of phytochemicals, tannins, alkaloids, flavonoids, glycosides, steroids, phenolic chemicals, and saponins. These substances are responsible for their antibacterial, anti-inflammatory, antioxidant, and wound-healing properties that support their conventional and medical applications (Sivakumar, 2024).

### VI. PHARMACEUTICAL ACTIVITIES

#### 6.1 Antibacterial Properties:

Evaluation of the antibacterial activities of *Acalypha indica* extracts was studied on *Bacillus subtilis*, *Staphylococcus aureus*, and *Klebsiella pneumoniae*. Different plant parts including leaves, stems, and roots, were extracted in ethyl acetate, hexane and methanol. Among them, the leaves and roots in ethyl acetate extracts showed the strongest antibacterial activities. Hexane and methanol extracts showed moderate effects; therefore, it can be concluded that *Acalypha indica* has potent antibacterial activity, primarily through bioactive phytochemicals (Gangadevi et al., 2008).

Hexane, chloroform, ethyl acetate and methanol extracts of leaves were evaluated. All of the extracts displayed anti-microbial activity against Gram positive bacteria including *S. epidermidis*, *B. cereus*, *Staphylococcus aureus* and *Streptococcus faecalis*. The minimum inhibitory Concentrations (MICs) were  $0.156 \leq$  and 2.5 mg/mL (Govindarajan et al., 2006).

### 6.2 Anti-Inflammatory Properties:

The screening of *Acalypha indica* leaf extract for its anti-inflammatory activity was determined based on HRBC membrane stabilization assay. Methanolic extracts of the leaves showed dose-dependent protection from hypotonicity-induced hemolysis. These findings show that the extract has moderate membrane-stabilizing effects, and these activities are related to its anti-inflammatory potential. *In vitro* experiments showed the inhibition reached by the extract was equivalent to that of typical anti-inflammatory agents. This is therefore an indication that the leaf extract may be a promising natural anti-inflammatory agent (Muzammil et al., 2014).

The aqueous ethanolic extract of *Acalypha indica* leaves has potent anti-inflammatory effects. It works by preventing protein denaturation in a lab setting. The more of the extract used, the stronger the effect, and it works as well as drugs like diclofenac. Bioactive substances like flavonoids, phenolics, and tannins can be the reason for this effect. These results back up the traditional use of *Acalypha indica* for inflammation and suggest it could be a good natural treatment for it (Akshayaa et al., 2021).

### 6.3 Antivenom activity:

Anti-venom activity of different *Acalypha indica* leaf extracts were studied against Russell's viper venom. Various solvent extracts were tested, and the acetone extract exhibited the strongest neutralizing effect. *In vitro* assays revealed significant inhibition of venom-induced hemolysis via HRBC membrane stabilization by the isolated compounds. *In vivo* experiments show effective protection results at 250, 500, and 750 mg/kg. Thus, *Acalypha indica* leaves possess potent anti-venom properties (Rajendran et al., 2010).

### 6.4 Antifungal Activity:

The ethanolic leaf extract of *Acalypha indica* showed strong antifungal activity when tested using the well diffusion method. Among the five fungi studied, the highest inhibition was observed for *Candida albicans* and *Aspergillus niger*. The extract produced clear zones of inhibition, confirming its efficacy. These results suggest that the bioactive compounds in the leaves are responsible for the antifungal effects. The study concludes that *Acalypha indica* leaves have potential for herbal antifungal drug development (Senthilkumar & Kiruba Rani, 2024).

The ethanolic leaf extract of *Acalypha indica* exhibited significant antifungal activity, particularly against *Candida albicans* (zones of inhibition 9–15 mm). GC–MS analysis identified key bioactive compounds such as squalene, phytol, and ethyl octanoate, which may be responsible for the antimicrobial effects. The study supports the plant's potential as a natural antifungal and antibacterial agent (Hussain & Ignatius, 2010).

### 6.5 Wound Healing Activity:

The ethanolic leaf extract of *Acalypha indica* was tested for wound healing activity using excision and incision wound models in rats. Topical application of 40 mg/kg extract resulted in faster wound contraction, rapid re-epithelialization, and improved tensile strength. The extract enhanced the expression of collagen types I and III, promoting better tissue regeneration. Histological studies revealed improved granulation tissue formation and collagen deposition in the treatment group. Thus, *Acalypha indica* effectively accelerates wound healing by boosting collagen synthesis and reducing oxidative stress (Ganeshkumar et al., 2012).

### 6.6 Antiulcer Activity:

The Anti-ulcer potential of ethanolic extract of *Acalypha indica* leaves was evaluated using pylorus ligation and indomethacin-induced ulcer models in Wistar albino rats. Oral administration of the extract at 200 mg/kg significantly reduced gastric volume, acidity, and ulcer index compared to that in the control group. The extract also increased mucus secretion and enhanced antioxidant activity, thereby protecting the gastric mucosa. Histopathological analysis confirmed reduced mucosal damage and improved tissue architecture in the treatment group. These findings suggest that *Acalypha indica* possesses strong anti-ulcer and gastroprotective properties (Senthilkumar & Kiruba Rani, 2024).

### 6.7 Antidiabetic properties:

Antidiabetic activity of *Acalypha indica* bark extracts in streptozotocin-induced diabetic rats. Various extracts (petroleum ether, chloroform, acetone, and methanol) were administered orally at 100 mg/kg for 21 days. The methanol extract of the bark showed the most significant reduction in fasting and postprandial blood glucose levels of the rats. Its hypoglycemic effect was comparable to that of the standard drug glibenclamide. This activity is attributed to the bioactive compounds, such as polyphenols and flavonoids, present in the extract. This suggests the methanol extract of *Acalypha indica* bark as a promising natural antidiabetic agent (Saha & Ahmed, 2011).

### 6.8 Anti-asthmatic Activity:

*Acalypha indica* ethanolic leaf extract was assessed for its anti-asthmatic properties. It inhibited tracheal contractions caused by acetylcholine and histamine. The extract reduced leukocytosis, eosinophilia, and stabilized mast cells. In animal models, it protected against bronchoconstriction and improved lung histology. Overall, it demonstrated strong anti-asthmatic effects through anticholinergic, antihistaminic, and anti-inflammatory mechanisms (Ninave & Patil, 2022).

### 6.9 Anti-malarial Activity:

The antimalarial activity of the Ethanolic and aqueous extract of *Acalypha indica* was evaluated. Phytochemical evaluation revealed the existence of alkaloids, flavonoids, tannins and saponins. The extracts were tested in vitro against *Plasmodium falciparum*. *Acalypha indica* showed significant suppression of the parasite's growth. Thus, *Acalypha indica* possesses promising potential for antimalarial drug development in the future (Brahmam & Sunita, 2018).

### 6.10 Anti-fertility Activity:

Ethanol and petroleum ether extracts of whole-plant *Acalypha indica* (600 mg/kg b.w) were screened for post-coital antifertility activity in female albino rats. Both extracts exhibited marked anti-implantation activities, abolishing the

implantations of embryos. The antifertility action was reversible, and normal fertility was restored following withdrawal of the treatment. Estrogenic activity was also shown for extracts that caused changes to uterine histology congruent with higher estragon. Anti-contraceptive effect through anti-implantation/ hormonal regulation (Hiremath et al., 1999)

#### 6.11 Diuretic Activity:

The diuretic activity of the ethanolic extract of *Acalypha indica* leaves was studied in rats. The increase the urine volume, was significant as compared to the control. It enhanced excretion of sodium and potassium ions and exhibited natriuretic and kaliuretic effects. Activity was dose-dependent and equivalent to that of the diuretic furosemide. Findings confirm *Acalypha indica* is a highly dependable diuretic, thus confirming its ethnomedical applications (Das et al., 2005)

#### 6.12 Anthelmintic Activity:

*Acalypha indica* leaf methanolic, aqueous and acetone extracts were examined against the earthworm *Pheretima posthuma*. All extracts induced paralysis in a dose-dependent manner and death of worms. *Acalypha indica* methanolic extract exhibited potent anthelmintic action. At 50 mg/ mL, it resulted in rapid paralysis; however, this was non-equivalent to the time of death of worms induced by standard albendazole (Wath et al., 2022)

#### 6.13 Anti-psoriatic Activity:

In the *in vitro* and *in vivo* testing of *Acalypha indica* extracts (aqueous as well as topical) for anti-psoriatic activity done in rodents, topical application at 250–500 mg/kg substantially decreased psoriatic lesions. Studies were done using A431 and B16-F10 Cell lines. Based on molecular docking, 2-methyl anthraquinone was the key effective phytoconstituent responsible for therapeutic effects. Overall, *Acalypha indica* demonstrated potential to become a natural anti-psoriatic drug by the induction of apoptosis and the topical Efficacy. (Bhatt et al., 2023) (Patil & Sharma, 2022)

#### 6.14 Antiviral Activity

Extracts of *Acalypha indica* (both methanol and water) possess a potent antiviral activity against SARS-CoV-2. *In vitro*, they block replication of the virus, probably as a result of inhibition of entry or replication. Extracts of these treatments substantially lower viral load relative to controls. The antiviral properties are linked to the occurrence of bioactive compounds, including flavonoids, phenolics, and terpenoids. These results indicate its possibility as a natural antiviral for further pharmacological studies (Sharma et al. .2025).

## VII. CONCLUSION

*Acalypha indica* is an important medicinal plant with a long history of traditional medicine in South and Southeast Asia. It is popular for its therapeutic potential, which is amply supported by a variety of bioactive phytochemicals such as alkaloids, flavonoids, Tannins, and saponins. Contemporary pharmaceutical research has now benefited many of these with known properties in some, but not all, of the applications towards which it has traditionally been used, corroborating its considerable value as a medicinal oil. Scientific research has clearly revealed several pharmacological activities, the antibacterial, anti-inflammatory, antivenom, antifungal has the significant medicinal relevance. Additionally, from its the capability to promote wound healing, its property to counter *Helicobacter pylori* infection and gastric ulcers has better therapeutic advantage. The leaves, in particular, have been identified as the richest source of these beneficial compounds, making them a primary focus for therapeutic applications. The comprehensive review of *Acalypha indica* underlines its importance as a promising source of natural medicines. Its proven efficacy against various ailments, coupled with its rich phytochemical profile, warrants further research and clinical studies to isolate specific bioactive compounds and develop new and effective herbal drugs. The integration of traditional this knowledge with modern scientific validation makes *Acalypha indica* a key plant in natural medicine.

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