Euphorbia Hirta Linn: An Integrative Exploration of Phytochemistry, Ethnomedicinal Applications, Pharmacological Activities, and Emerging Therapeutic Prospects

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ABSTRACT

Euphorbia hirta Linn. is an important medicinal plant that has been extensively used in traditional health-care systems because of its diverse therapeutic properties. The present review summarizes the botanical characteristics, ethnomedicinal applications, phytochemical constituents, pharmacological activities, safety profile, and future therapeutic prospects of the plant. Information was synthesized from previously published scientific literature focusing on the biological activities and chemical composition of *Euphorbia hirta*. Numerous studies have reported the presence of flavonoids, tannins, terpenoids, alkaloids, phenolic acids, and sterols, which contribute to its medicinal value. Experimental investigations have demonstrated significant antibacterial, antioxidant, anti-inflammatory, antidiabetic, anticancer, antimalarial, antiasthmatic, and antiviral activities. Recent findings have also highlighted the potential role of the plant in the development of novel therapeutic agents for infectious and chronic diseases. Despite its promising pharmacological profile, further studies are required to establish standardized extraction methods, determine long-term safety, and validate its clinical efficacy. The findings of this review emphasize the importance of *Euphorbia hirta* as a valuable source of bioactive compounds and a promising candidate for future pharmaceutical applications.

Keywords: *Euphorbia hirta*, phytochemistry, ethnopharmacology, medicinal plants, antioxidants, antimicrobial activity, pharmacology, traditional medicine.

INTRODUCTION

Medicinal plants have played a fundamental role in the evolution of traditional and modern health-care systems. For thousands of years, human societies have relied upon naturally occurring compounds derived from plants to prevent and treat various diseases. Advances in phytochemistry, molecular biology, and pharmaceutical sciences have further emphasized the importance of medicinal plants as valuable sources of novel therapeutic agents.

Among numerous medicinal species, *Euphorbia hirta* Linn. has emerged as a plant of considerable scientific interest because of its extensive pharmacological potential and widespread traditional use. The plant belongs to the family Euphorbiaceae and is commonly known as the "asthma plant" because of its historical use in the management of respiratory disorders. It is widely distributed throughout tropical and subtropical regions and has adapted successfully to diverse environmental conditions. Previous investigations have indicated that the plant possesses remarkable therapeutic value owing to its abundant phytochemical constituents.

Traditional medical practitioners have used different parts of the plant to manage gastrointestinal disorders, skin infections, inflammatory diseases, fever, bronchitis, asthma, dysentery, and wound infections. The extensive therapeutic utilization of *Euphorbia hirta* has stimulated scientific investigations aimed at identifying the underlying mechanisms responsible for these biological activities. Various studies have revealed the presence of alkaloids, terpenoids, tannins, flavonoids, coumarins, glycosides, sterols, and phenolic compounds. These secondary metabolites are responsible for numerous biological properties, including antioxidant, antimicrobial, anticancer, antiviral, and immunomodulatory activities.

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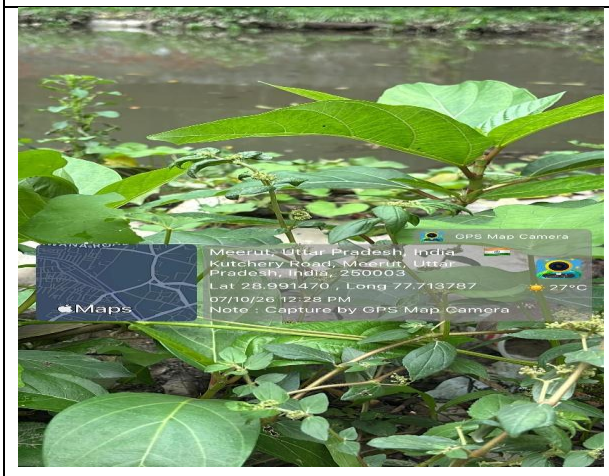
Recent global health challenges have further increased interest in medicinal plants possessing antiviral properties. Owing to the presence of diverse phytochemicals and their potential interactions with cellular receptors, *Euphorbia hirta* has been investigated as a promising candidate for complementary therapeutic approaches. Although substantial progress has been made, considerable challenges remain regarding the standardization, quality control, safety assessment, and clinical validation of the plant's bioactive constituents.

The principal objective of the present review is to provide an integrated overview of the phytochemical composition, traditional applications, pharmacological activities, therapeutic significance, and future research prospects associated with *Euphorbia hirta*.

Botanical Classification and Taxonomy

The taxonomic classification of *Euphorbia hirta* is summarized below:

Taxonomic rank	**Classification**
Kingdom	Plantae
Division	Spermatophyta
Class	Dicotyledonae
Order	Euphorbiales
Family	Euphorbiaceae
Genus	*Euphorbia*
Species	*Euphorbia hirta* Linn.
	

The plant is an annual herbaceous species characterized by a slender stem covered with fine hairs and containing abundant milky latex. Mature plants generally attain heights ranging from 40 cm to 70 cm. The leaves are opposite, elliptical, and serrated along their margins. Small flowers are arranged in specialized inflorescences known as cyathia. The fruit is a three-lobed capsule containing wrinkled seeds.

Ethnomedicinal Significance

For centuries, *Euphorbia hirta* has occupied a prominent position in traditional medical systems throughout Asia, Africa, and South America. Owing to its broad therapeutic spectrum, different communities have incorporated the plant into indigenous healing practices aimed at managing numerous physiological disorders. Traditional healers generally employ leaves, stems, roots, flowers, and latex in the preparation of infusions, decoctions, poultices, and powders.

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Historically, the plant has been used extensively to manage respiratory ailments such as bronchitis, asthma, cough, emphysema, and hay fever. Its traditional designation as the "asthma plant" reflects the widespread belief that it possesses bronchodilatory properties capable of reducing airway inflammation and improving respiratory function. The Zhuang and Dai communities in China have traditionally administered preparations of *Euphorbia hirta* to alleviate chronic respiratory disorders and stimulate milk production among nursing mothers.

Apart from respiratory disorders, the plant has been used in treating diarrhea, dysentery, intestinal parasitic infections, skin disorders, wounds, ulcers, conjunctivitis, kidney stones, and inflammatory conditions. In several communities, the latex is applied externally to treat boils, swelling, and dermatological infections. Root extracts have also been employed in the management of vomiting, gastrointestinal disturbances, and snake bites.

The extensive ethnopharmacological applications of *Euphorbia hirta* suggest that the plant constitutes an important reservoir of biologically active compounds with considerable therapeutic potential. However, despite the rich history of traditional use, many mechanisms of action remain insufficiently understood and require systematic scientific investigation.

Phytochemical Composition

The medicinal value of *Euphorbia hirta* is primarily attributed to its diverse phytochemical profile. Scientific investigations have demonstrated the presence of numerous secondary metabolites possessing significant biological activity. The principal constituents include flavonoids, terpenoids, alkaloids, tannins, glycosides, phenolic compounds, steroids, coumarins, proteins, carbohydrates, and essential oils.

Flavonoids

Flavonoids constitute one of the most extensively studied groups of phytochemicals found in *Euphorbia hirta*. These compounds contribute significantly to the antioxidant, anti-inflammatory, antimicrobial, and anticancer activities associated with the plant.

Important flavonoids include:

- Quercetin
- Quercitrin
- Myricitrin
- Rutin
- Kaempferol
- Leucocyanidin
- Afzelin

These compounds act as effective scavengers of reactive oxygen species and play an essential role in cellular protection against oxidative damage.

Terpenoids and Steroids

Terpenoids contribute substantially to the pharmacological profile of *Euphorbia hirta*. Studies have identified α-amyrin, β-amyrin, taraxerol, taraxerone, cycloartenol, and several sterol derivatives, including β-sitosterol and stigmasterol. These compounds exhibit potent anti-inflammatory, antimicrobial, and anticancer activities.

Phenolic Compounds and Tannins

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Phenolic compounds and tannins represent another important category of bioactive substances identified within the plant. Among the most important constituents are gallic acid, protocatechuic acid, euphorbins A, B, C, and D, and galloyl derivatives. These compounds contribute significantly to the antioxidant and antimicrobial properties of the plant.

Mineral Constituents

The plant also contains essential minerals, including calcium, magnesium, phosphorus, iron, zinc, manganese, and copper. These elements contribute to various metabolic pathways and enhance the nutritional value of the plant.

Pharmacological Activities

Antibacterial Activity

Numerous investigations have demonstrated the antibacterial efficacy of *Euphorbia hirta* extracts against both Gram-positive and Gram-negative bacteria. Methanolic, ethanolic, and aqueous extracts have exhibited inhibitory activity against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, and *Klebsiella pneumoniae*.

The antibacterial activity appears to be associated with the synergistic action of flavonoids, tannins, alkaloids, and terpenoids, which interfere with microbial metabolism and cellular integrity.

Antioxidant Activity

Oxidative stress has been recognized as a major contributor to numerous chronic diseases, including cancer, diabetes mellitus, cardiovascular disorders, and neurodegenerative conditions. Antioxidants present within *Euphorbia hirta* protect cells against oxidative damage by neutralizing free radicals.

Experimental studies employing DPPH, ABTS, and ferric reducing antioxidant power assays have demonstrated substantial antioxidant activity, particularly in leaf extracts. The elevated concentrations of flavonoids and phenolic compounds appear to be primarily responsible for these effects.

Anti-inflammatory Activity

Inflammation represents a protective biological response; however, chronic inflammation contributes to the development of numerous pathological conditions. Extracts obtained from *Euphorbia hirta* have shown significant anti-inflammatory effects in experimental animal models.

Several mechanisms have been proposed to explain these observations, including the inhibition of cyclooxygenase activity, suppression of pro-inflammatory cytokines, and reduction of oxidative stress. Research has further indicated concentration-dependent inhibition of inflammatory pathways following treatment with plant extracts.

Antidiabetic Activity

Diabetes mellitus remains one of the most challenging metabolic disorders worldwide. Traditional practitioners have long employed *Euphorbia hirta* as an antidiabetic remedy.

Scientific studies suggest that plant extracts contribute to blood glucose regulation through improvements in insulin sensitivity, enhancement of glucose metabolism, and inhibition of carbohydrate-degrading enzymes.

Anticancer Activity

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The development of naturally derived anticancer compounds has become an important area of biomedical research. Several investigations have revealed that extracts derived from *Euphorbia hirta* exhibit antiproliferative effects against multiple cancer cell lines.

The presence of flavonoids, tannins, and terpenoids appears to contribute to these effects by regulating apoptosis, suppressing oxidative damage, and inhibiting cellular proliferation. Although the findings are promising, further investigations are required to evaluate their clinical applicability.

Antiviral Activity

Recent scientific attention has focused on the antiviral properties of *Euphorbia hirta*. Experimental investigations have demonstrated inhibitory activity against numerous viral pathogens, including dengue virus, coxsackievirus, human immunodeficiency virus, and influenza virus. Recent evidence has also suggested the possibility of interactions between plant-derived compounds and molecular targets associated with coronavirus infections.

The antiviral activity of *Euphorbia hirta* may be associated with the inhibition of viral replication, interference with viral attachment mechanisms, and modulation of immune responses.

Mechanisms of Action

The therapeutic efficacy of *Euphorbia hirta* arises from the synergistic interaction of numerous bioactive compounds rather than from a single constituent. Flavonoids, tannins, terpenoids, sterols, and phenolic acids collectively contribute to the plant's broad pharmacological profile.

Antioxidant Mechanisms

Oxidative stress results from an imbalance between reactive oxygen species (ROS) production and antioxidant defense mechanisms. Excessive concentrations of ROS can damage proteins, nucleic acids, lipids, and cellular membranes.

Phenolic compounds such as quercetin, rutin, gallic acid, and myricitrin act as potent antioxidants by:

- Neutralizing free radicals;
- Chelating transition metal ions;
- Preventing lipid peroxidation;
- Stabilizing cellular membranes;
- Enhancing endogenous antioxidant activity.

These mechanisms contribute significantly to cellular protection and disease prevention.

Anti-inflammatory Mechanisms

Inflammatory responses involve numerous signaling pathways, including the activation of cyclooxygenase enzymes, nuclear factor-kappa B (NF-κB), prostaglandins, and pro-inflammatory cytokines.

Extracts obtained from *Euphorbia hirta* appear to suppress these pathways through several mechanisms:

- Inhibition of prostaglandin synthesis;
- Suppression of inflammatory mediator release;
- Reduction of cytokine production;

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- Attenuation of oxidative stress.

Collectively, these processes contribute to reduced tissue damage and accelerated recovery from inflammatory conditions.

Antimicrobial Mechanisms

The antimicrobial properties of *Euphorbia hirta* are associated with the disruption of microbial cell membranes, inhibition of nucleic acid synthesis, alteration of protein metabolism, and interference with enzyme activity. Polyphenolic compounds and flavonoids exhibit remarkable antimicrobial activity through multiple biochemical pathways, thereby reducing the possibility of resistance development.

Anticancer Mechanisms

Cancer development is influenced by numerous factors, including genetic alterations, environmental exposure, oxidative stress, and chronic inflammation. Experimental evidence suggests that *Euphorbia hirta* extracts may contribute to cancer prevention and treatment through the following mechanisms:

- Induction of programmed cell death (apoptosis);
- Inhibition of angiogenesis;
- Suppression of abnormal cellular proliferation;
- Prevention of DNA damage;
- Regulation of intracellular signaling pathways.

Although these observations are encouraging, extensive clinical investigations remain necessary before therapeutic applications can be established.

Toxicological Considerations and Safety Profile

The increasing popularity of herbal medicines necessitates careful evaluation of their safety and toxicity. Despite the long history of traditional use associated with *Euphorbia hirta*, comprehensive toxicological investigations remain relatively limited.

Several experimental studies have suggested that moderate doses of plant extracts produce minimal adverse effects. Nevertheless, prolonged exposure and excessive consumption may lead to undesirable physiological consequences owing to the presence of highly active phytochemicals and latex components.

Potential adverse effects may include:

- Gastrointestinal irritation;
- Allergic reactions;
- Reproductive disturbances;
- Altered liver enzyme activity;
- Interactions with pharmaceutical drugs.

The absence of large-scale clinical studies highlights the necessity for additional investigations concerning dosage standardization, toxicity evaluation, and pharmacokinetic characterization.

Research Gaps and Future Perspectives

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Although significant progress has been achieved in understanding the pharmacological potential of *Euphorbia hirta*, numerous scientific questions remain unresolved.

The principal limitations identified in previous investigations include:

- Limited human clinical trials;
- Variability in extraction methods;
- Inadequate standardization procedures;
- Insufficient information concerning pharmacokinetics;
- Restricted toxicological investigations;
- Incomplete characterization of molecular mechanisms.

Future investigations should focus on the development of standardized extraction protocols and advanced analytical methods for the identification of biologically active compounds.

Several promising areas of investigation include:

- Nanotechnology-based drug delivery systems;
- Molecular docking studies;
- Metabolomic investigations;
- Pharmacogenomic analyses;
- Clinical trials;
- Artificial intelligence-assisted drug discovery;
- Novel antiviral therapeutics.

The integration of traditional knowledge and contemporary biomedical research may facilitate the development of innovative therapeutic agents derived from *Euphorbia hirta*.

CONCLUSION

Euphorbia hirta has emerged as a highly valuable medicinal species because of its extensive ethnomedicinal applications and diverse phytochemical composition. Scientific investigations have demonstrated that the plant possesses remarkable antioxidant, antibacterial, anti-inflammatory, antidiabetic, antitumor, antimalarial, antiasthmatic, and antiviral properties. These biological activities are largely attributable to the synergistic effects of flavonoids, tannins, phenolic acids, alkaloids, and terpenoids.

The increasing global demand for naturally derived therapeutic agents has intensified scientific interest in *Euphorbia hirta* and related medicinal plants. Although preclinical findings have yielded encouraging results, substantial work remains necessary to establish the safety, efficacy, and therapeutic value of these compounds in human populations.

Consequently, multidisciplinary research efforts involving pharmacologists, chemists, botanists, clinicians, and biotechnologists will be essential to unlock the full therapeutic potential of this remarkable medicinal plant. Future advances in molecular biology, computational chemistry, and pharmaceutical technology may ultimately facilitate the development of novel drugs based upon the bioactive constituents of *Euphorbia hirta*.

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REFERENCES

1. Asha, S., & Pushpangadan, P. (1998). Preliminary evaluation of the antioxidant activity of Euphorbia hirta extracts. Journal of Ethnopharmacology, 63(2), 193–198.
2. Baslas, R. K., & Agarwal, R. (1980). Chemical investigation of Euphorbia hirta Linn. Journal of the Indian Chemical Society, 57, 880–881.
3. Blanc, P., Bertrand, P., de Saqui-Sannes, G., & Lescure, R. (1963). Galactogenic properties of plants of the African flora: Sersalisia djalonensis and Euphorbia hirta. Annales de Biologie Clinique, 21, 829–832.
4. Burkill, H. M. (1994). The useful plants of West Tropical Africa (2nd ed., Vol. 2). Royal Botanic Gardens, Kew.
5. Chopra, R. N., Chopra, I. C., Handa, K. L., & Kapur, L. D. (1994). Indigenous drugs of India (2nd ed.). Academic Publishers.
6. Duke, J. A. (2002). Handbook of medicinal herbs (2nd ed.). CRC Press.
7. Galvez, J., Crespo, M. E., Jimenez, J., Suarez, A., & Zarzuelo, A. (1993). Antidiarrhoeic activity of quercitrin in mice and rats. Journal of Pharmacy and Pharmacology, 45(2), 157–159.
8. Galvez, J., Zarzuelo, A., Crespo, M. E., Lorente, M. D., Ocete, M. A., & Jimenez, J. (1993). Antidiarrheal activity of Euphorbia hirta extract and isolation of an active flavonoid constituent. Planta Medica, 59(4), 333–336.
9. Gnecco, S., Perez, C., Bittner, M., & Silva, Y. M. (1996). Distribution pattern of n-alkanes in Chilean species of the Euphorbiaceae family. Boletín de la Sociedad Chilena de Química, 41, 229–233.
10. Harbone, J. B. (1998). Phytochemical methods: A guide to modern techniques of plant analysis (3rd ed.). Chapman and Hall.
11. Johnson, P. B., Abdurahman, E. M., Tiam, E. A., Abdu-Aguye, I., & Hussaini, I. M. (1999). Euphorbia hirta leaf extracts increase urine output and electrolyte excretion in rats. Journal of Ethnopharmacology, 65(1), 63–69.
12. Khursheed, A., Jain, V., & Wani, A. R. (2022). Euphorbia hirta as a gold mine of high-value phytochemicals: A comprehensive review of its pharmacological activities and possible role against SARS-CoV-2. Biomedical Research and Therapy, 9(2), 4930–4949.
13. Kirtikar, K. R., & Basu, B. D. (2003). Indian medicinal plants (Vol. 3). Oriental Enterprises.
14. Kirtikar, K. R., & Basu, B. D. (2003). Indian Medicinal Plants. Oriental Enterprises.
15. Kokwaro, J. O. (2009). Medicinal plants of East Africa (3rd ed.). University of Nairobi Press.
16. Kumar, S., Malhotra, R., & Kumar, D. (2010). Euphorbia hirta: Its chemistry, traditional and medicinal uses, and pharmacological activities. Pharmacognosy Reviews, 4(7), 58–61.
17. Lanhers, M. C., Fleurentin, J., Dorfman, P., Mortier, F., & Pelt, J. M. (1991). Analgesic, antipyretic and anti-inflammatory properties of Euphorbia hirta. Planta Medica, 57(3), 225–231.
18. Liu, Y., Murakami, N., Ji, H., Abreu, P., & Zhang, S. (2007). Antimalarial flavonol glycosides from Euphorbia hirta. Pharmaceutical Biology, 45(4), 278–281.
19. Martínez, V., Mariano, A., Teresa, O. R., Lazcano, M. E., & Bye, R. (1999). Anti-inflammatory active compounds from the n-hexane extract of Euphorbia hirta. Revista de la Sociedad Química de México, 43, 103–105.
20. Mathur, A., Dixit, V. P., & Dobal, M. P. (1995). Antifertility effects of Euphorbia hirta in male experimental models. Proceedings of the International Symposium on Male Contraception, 105–109.
21. Mohamed, S., Saka, S., El-Sharkawy, S. H., Ali, A. M., & Muid, S. (1996). Antifungal screening of Malaysian medicinal plants against plant pathogens. Pesticide Science, 47(3), 259–264.
22. Nadkarni, K. M. (1976). Indian materia medica (Vol. 1). Popular Prakashan.
23. Ogbulie, J. N., Ogueke, C. C., Okoli, I. C., & Anyanwu, B. N. (2007). Antibacterial activities and toxicological potentials of crude ethanolic extracts of Euphorbia hirta. African Journal of Biotechnology, 6(13), 1544–1548.
24. Prajapati, N. D., Purohit, S. S., Sharma, A. K., & Kumar, T. (2003). Handbook of Medicinal Plants. Agrobios Publishers.
25. Prajapati, N. D., Purohit, S. S., Sharma, A. K., & Kumar, T. (2003). A handbook of medicinal plants. Agrobios.
26. Rastogi, R. P., & Mehrotra, B. N. (2002). Compendium of Indian Medicinal Plants. Central Drug Research Institute.

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27. Rastogi, R. P., & Mehrotra, B. N. (2002). Compendium of Indian medicinal plants (Vols. 3–4). Central Drug Research Institute.
28. Sharma, N. K., Dey, S., & Prasad, R. (2007). In vitro antioxidant potential evaluation of Euphorbia hirta. Pharmacology Online, 1, 91–98.
29. Singh, P., & Sinha, K. K. (1986). Inhibition of aflatoxin production through aqueous plant extracts. Journal of the Indian Botanical Society, 65, 30–32.
30. Sofowora, A. (2008). Medicinal plants and traditional medicine in Africa (3rd ed.). Spectrum Books.
31. Suresh, K., Deepa, P., Harisaranraj, R., & Achudhan, V. V. (2008). Antimicrobial and phytochemical investigation of medicinal plants, including Euphorbia hirta. Ethnobotanical Leaflets, 12, 1184–1190.
32. Tona, L., Kambu, K., Ngimbi, N., Mesia, K., Penge, O., Lusakibanza, M., Cimanga, K., De Bruyne, T., Apers, S., Totte, J., Pieters, L., & Vlietinck, A. J. (2000). Antiamoebic and antispasmodic activities of extracts from traditional medicinal preparations. Phytomedicine, 7(1), 31–38.
33. Trease, G. E., & Evans, W. C. (2009). Trease and Evans' pharmacognosy (16th ed.). Saunders Elsevier.
34. Van Wyk, B. E., & Wink, M. (2015). Medicinal plants of the world. CABI Publishing.
35. Williamson, E. M. (2002). Major Herbs of Ayurveda. Churchill Livingstone.
36. World Health Organization. (2013). WHO traditional medicine strategy 2014–2023. World Health Organization.
37. Yadav, R. N. S., & Agarwala, M. (2011). Phytochemical analysis of some medicinal plants. Journal of Phytology, 3(12), 10–14.
38. Zarzuelo, A., Crespo, E., Jimenez, J., & Galvez, J. (1993). Antidiarrheal activity of flavonoids isolated from Euphorbia hirta. Planta Medica, 59(4), 333–336.