A Comprehensive Review on Pharmacological Activity of Euphorbia Hirtaand Euphorbia Noriifolia.

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Abstract:

Euphorbia hirta and *Euphorbia neriifolia*, two important members of the Euphorbiaceae family, have long been used in traditional medicine for the management of respiratory, gastrointestinal, inflammatory, and infectious diseases. Both species are phytochemicallyrich, containing flavonoids, tannins, alkaloids, terpenoids, sterols, and phenolics that contribute to a wide spectrum of therapeutic effects. Comparative pharmacological investigations reveal that they share several common biological activities, notably antimicrobial,anti-inflammatory,antioxidant,analgesic,wound-healing,immunomodulatory, and anticancer properties. *E. hirta* is particularly valued for its use in asthma, diarrhea, and microbial infections, while *E. neriifolia* is employed in inflammation, skin disorders, and tumor management. Their antimicrobial efficacy has been demonstrated against Gram- positive and Gram-negative bacteria as well as pathogenic fungi. Potent antioxidant activity, largely attributed to flavonoids and terpenoids, plays a crucial role in protecting against oxidative stress–related disorders. Anti-inflammatory and analgesic properties are linked to modulation of inflammatory mediators and pain pathways, while wound-healing and immunomodulatory effects highlight their contribution to tissue repair and immune defense. Moreover, both species show promising anticancer potential, with extracts displaying cytotoxicity against breast, cervical, and liver carcinoma cell lines. Despite these promising findings, limitations remain in terms of standardized clinical validation and toxicity profiling. Therefore, further research is essential to isolate bioactive lead compounds, elucidate molecular mechanisms, and develop advanced formulations, such as nanoparticle-based delivery systems, to improve bioavailability and therapeutic efficacy. Collectively, *E. hirta* and *E. neriifolia* represent valuable medicinal resources that bridge traditional knowledge with modern pharmacological validation.

Keywords: Euphorbiahirta, Euphorbianeriifolia,pharmacologicalactivity,phytochemicals, antimicrobial, anti-inflammatory, antioxidant, anticancer.

Introduction:

Medicinal plants have served as a foundation for traditional healing systems and modern drug discovery due to their rich phytochemical diversity and therapeutic potential .Among these, the *Euphorbia* genus, belonging to the family Euphorbiaceae, comprises more than 2000 species widely distributed in tropical and subtropical regions. Many species of this genus are known for their distinctive milky latex and are used extensively in Ayurveda, Siddha, Unani, and folk medicine. Two important members of this genus, *Euphorbia hirta* and *Euphorbia neriifolia*, have gained significant attention for their broad spectrum of pharmacological activities and ethnomedicinal importance.

Euphorbia hirta, commonly known as "Asthma weed" or "Dudhi," is a small annual herb found abundantly in tropical climates. It is traditionally used in the treatment of respiratory disorders such as asthma, bronchitis, and cough, as well as gastrointestinal ailments like diarrhea, dysentery, and ulcers. Phytochemical investigations have revealed that *E. hirta* contains a wide range of bioactive constituents ,including flavonoids, tannins, triterpenoids, saponins, and essential oils. These compounds contribute to its diverse pharmacological actions such as antimicrobial, anti-inflammatory, antioxidant, antimalarial, and antidiabetic activities.

On the other hand, *Euphorbia neriifolia*, commonly referred to as "Indian Spurge Tree" or "Sehund," is a succulent shrub traditionally used inAyurvedic formulations. It is known for its therapeutic applications in respiratory diseases, skin infections, edema, and tumors. The plant latex and extracts are reported to possess analgesic, anti-inflammatory, antimicrobial, andcytotoxicproperties.Phytochemical studies have identified the presence of diterpenoids, steroids, glycosides, and phenolic compounds, which are believed to be responsible for its pharmacological potential.

Both *E. hirta* and *E. neriifolia* demonstrate a wide range of biological activities supported by scientific studies, making them promising candidates for further pharmacological and phytochemical investigations. A comparative understanding of their bioactive constituents and therapeutic effects can provide insights for developing novel herbal formulations and natural drug leads. Therefore, this comprehensive review aims to summarize and evaluate the existing literature on the phytochemistry and pharmacological properties of *Euphorbia hirta* and *Euphorbia neriifolia*, highlighting their potential roles in modern medicine and future research prospects.

Synonyms:

Euphorbia hirta:

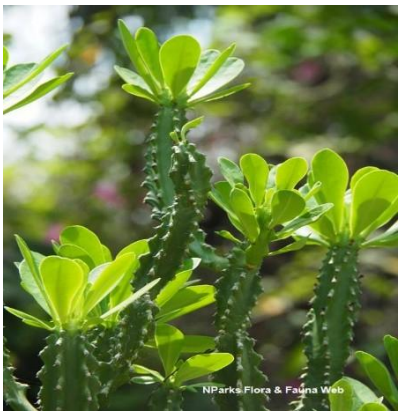
- *Chamaesyce hirta* (L.) Millsp.
- *Euphorbia pilulifera* L.
- *Euphorbia capitata* Lam.
- *Tithymalushirtus*(L.)Moench
- *Euphorbia hirtella* Roxb

Common names: Asthma weed, Pill-bearing spurge, Snakeweed

Euphorbia neriifolia synonyms:

- *Tithymalus neriifolius* (L.) Klotzsch & Garcke
- *Euphorbia ligularia* Roxb.
- *Euphorbia pentagona* Roxb.
- *Euphorbia royleana* var. *neriifolia* (L.) Boiss.

Common names: Indian Spurge Tree, Sehund, Thohar



Scientific classification:

classification	Euphorbia hirta	Euphorbia neriifolia
Domain	Eukarya	Eukarya
Kingdom	Plantae	Plantae
Phylum	Magnoliophyta (Angiosperms)	Magnoliophyta (Angiosperms)
Subphylum	Spermatophytina	Spermatophytina
Class	Magnoliopsida (Dicotyledons)	Magnoliopsida (Dicotyledons)
Order	Malpighiales	Malpighiales
Family	Euphorbiaceae	Euphorbiaceae
Genus	Euphorbia	Euphorbia
Species	E. hirta	E. neriifolia

Vernacular names:

Euphorbia hirta

- International (English): Asthma weed, Snake weed, Pill-bearing spurge
- India:
    - Tamil: Amman Pacharisi
    - Hindi: Dudhi
    - Malayalam: Cherula
    - Telugu: Nilapala
    - Kannada: Ammanabhalli
    - Marathi: Dudhani
    - Bengali: Dudhghas
- Chinese: 小叶大戟 (*Xiǎo yè dà jǐ*)
- Spanish: Hierba del asma
- Indonesian: Patikan kebo
- Swahili: Mkaa wa punda

Euphorbia neriifolia

- International (English): Indian spurge tree, Oleander spurge
- India:
    - Tamil: Elumbotti
    - Hindi: Sehund, Thuhar
    - Malayalam: Kalli
    - Telugu: Nallamadu
    - Kannada: Kalli gida
    - Bengali: Manasa lata
- Chinese: 大戟 (*Dà jǐ*)
- Spanish: Lechetrezna de la India
- Indonesian: Susu kambing

Traditional uses:

Euphorbia

Euphorbia hirta was used in the treatment of gastrointestinal disorders, bronchial and other respiratory diseases, conjunctivitis, to increase milk flow in lactating women and for other female diseases.It was also used for intestinal parasites, diarrhoea, peptic ulcers, heartburn, vomiting, amoebic dysentery, asthma, bronchitis, hay fever, laryngeal spasms, emphysema, coughs, colds, kidney stones, menstrual problems, sterility, venereal diseases, skin and mucous membranes diseases, including (warts, scabies, tinea, thrush, aphthae, fungal afflictions, measles), as an antiseptic to treat wounds, sores, and conjunctivitis. The plant has a reputation as an analgesic to treat severe headaches, toothache, rheumatism, colic, and pains during pregnancy. It was also used as an antidote and pain relief for scorpion stings and snakebites. In India, it was used to treat worm infections in children and for dysentery, gonorrhea, jaundice, pimples, digestive problems, and tumors. The fresh milky latex was applied to wounds and warts. Roots of the plant were used for sprains and inflammation, miscarriage, epilepsy, maggots in wounds, and irregular tooth growth.

Euphorbia neriifolia:

In the traditional system, leaves are used as an aphrodisiac, diuretic, and cough and cold medicine, as well as for the treatment of bronchitis and bleeding piles. Stomachic, carminative, and expectorant qualities are attributed to the leaves. Bigonia and Rana discovered that hydroalcoholic leaf extracts exhibited mild central nervous system depressant, wound-healing, and immunomodulatory effects. A fluid generated from roasted leaves is used to relieve earache. Burkill and Haniff assert that this is also the case in Malaya. The juice derived from the leaves is claimed to be quite good at alleviating spasmodic asthma paroxysms. The presence of flavonoids is thought to be responsible for the anti-inflammatory and analgesic properties of *Euphorbia neriifolia* hydroalcoholic leaves extract. The juice of the leaves is used to alleviate earaches in the Philippines.

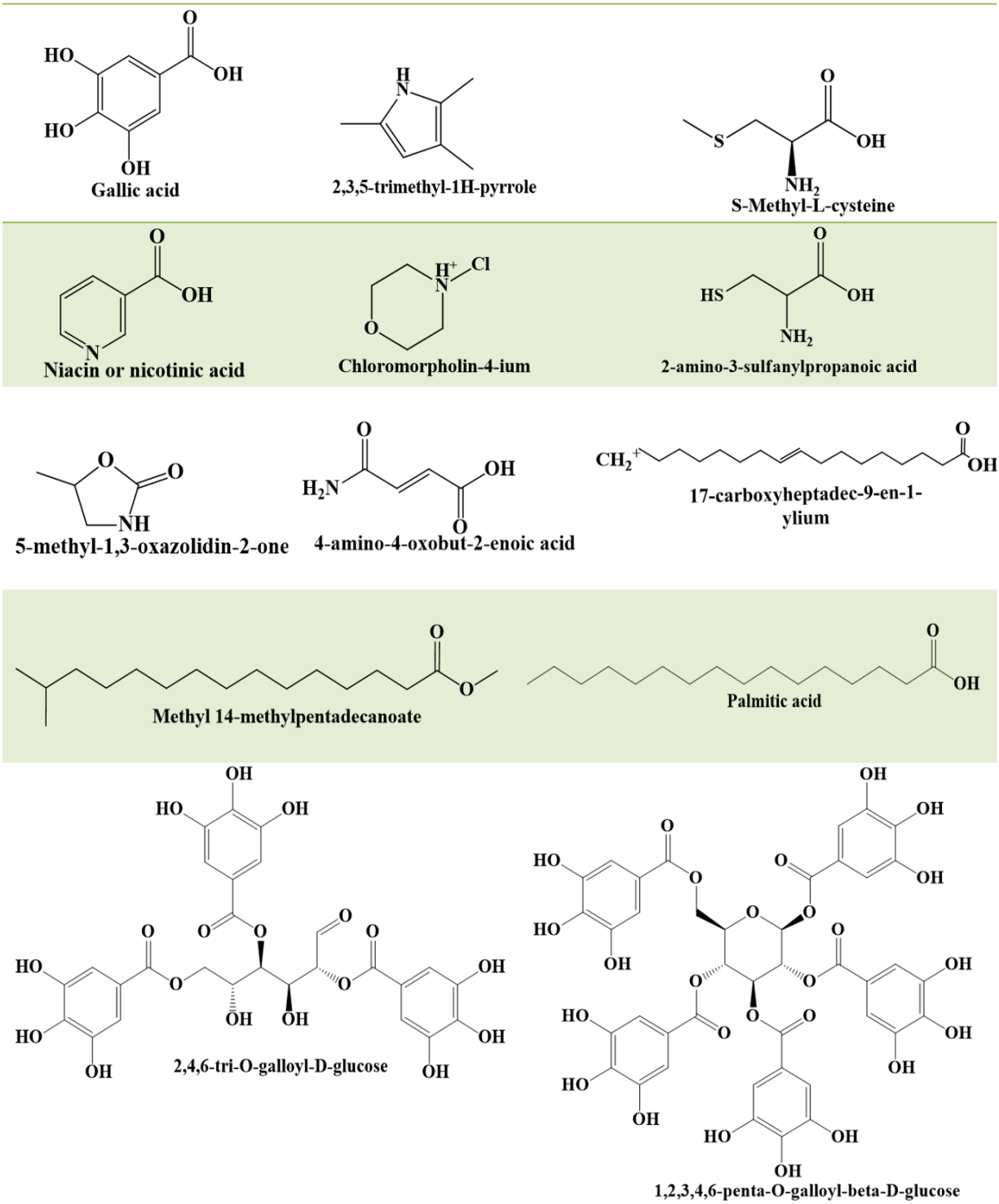
Itching, pain, and edema are relieved by applying *E. neriifolia* leaves on piles. When youngsters have respiratory difficulties, *E. neriifolia* leaf extract combined with common salt and honey is used topically and orally. To heal severe cracks in the soles of the feet, boiling *E. neriifolia* milk is administered topically together with castor oil and salt.

Chemical constituents of Euphorbia hirta, Euphorbia neriifolia:

Euphorbia hirta:

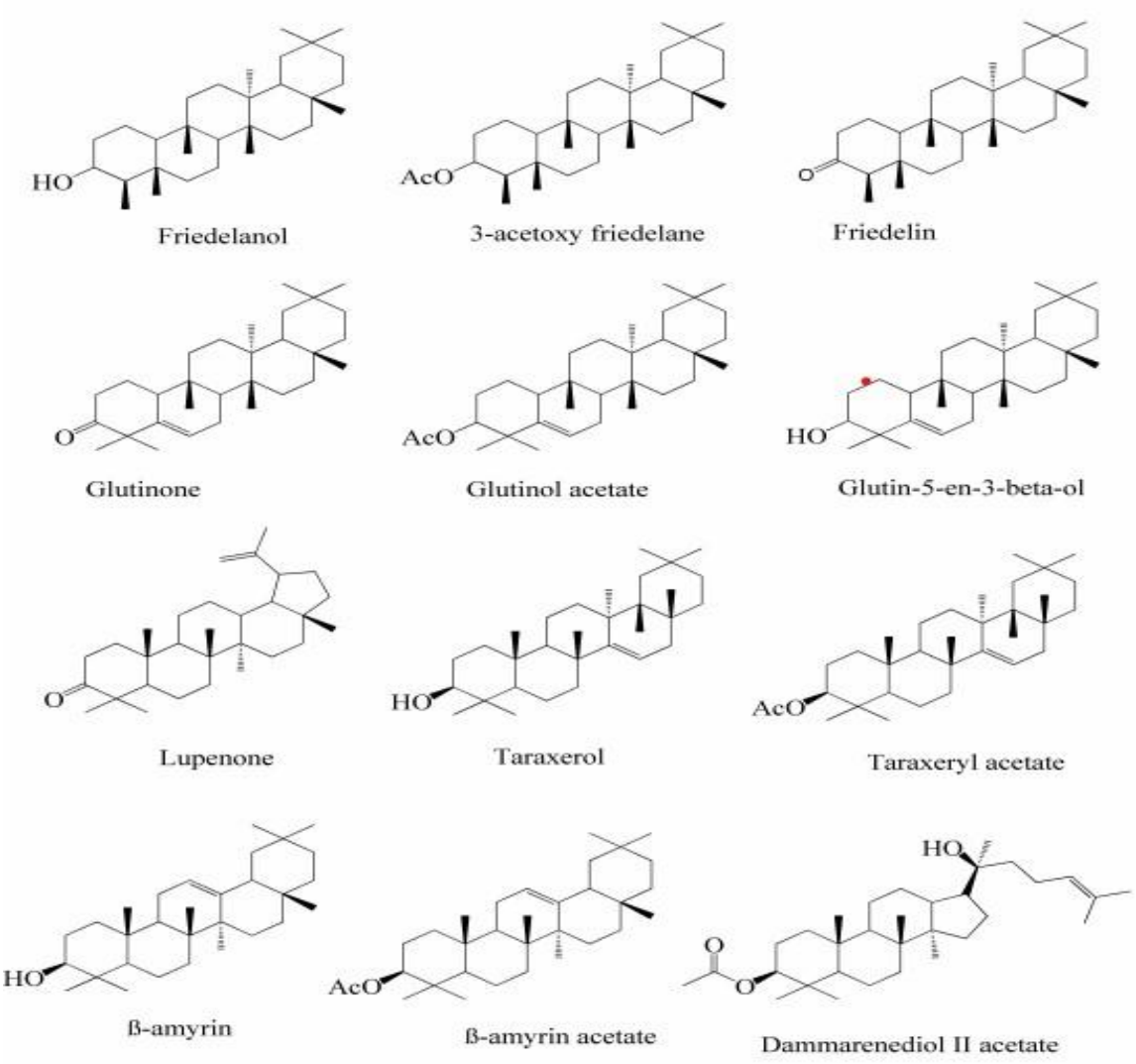
The phytochemical profile of Euphorbia hirta is diverse, with several classes of bioactive compounds identified in different parts of the plant. These include alkaloids, flavonoids, tannins, saponins, terpenoids, and phenolic acids, responsible for the plant's wide range of pharmacological activities. E. hirta has been studied by various workers, and many active constituents have been isolated. Afzelin (I), quercitrin (II), and myricitrin (III) have been isolated from the methanolic extract of E. hirta. The chemical investigation of E. hirta has led to the isolation of rutin (IV), quercitin (V), euphorbin-A (VI), euphorbin-B (VII), euphorbin-C (VIII), euphorbin-D (IX), 2,4,6-tri-O-galloyl-β-D-glucose, 1,3,4,6-tetra-O-galloyl-β-D-glucose, kaempferol, gallic acid, and protocatechuic acid. E. hirta also contains β-amyrin, 24-

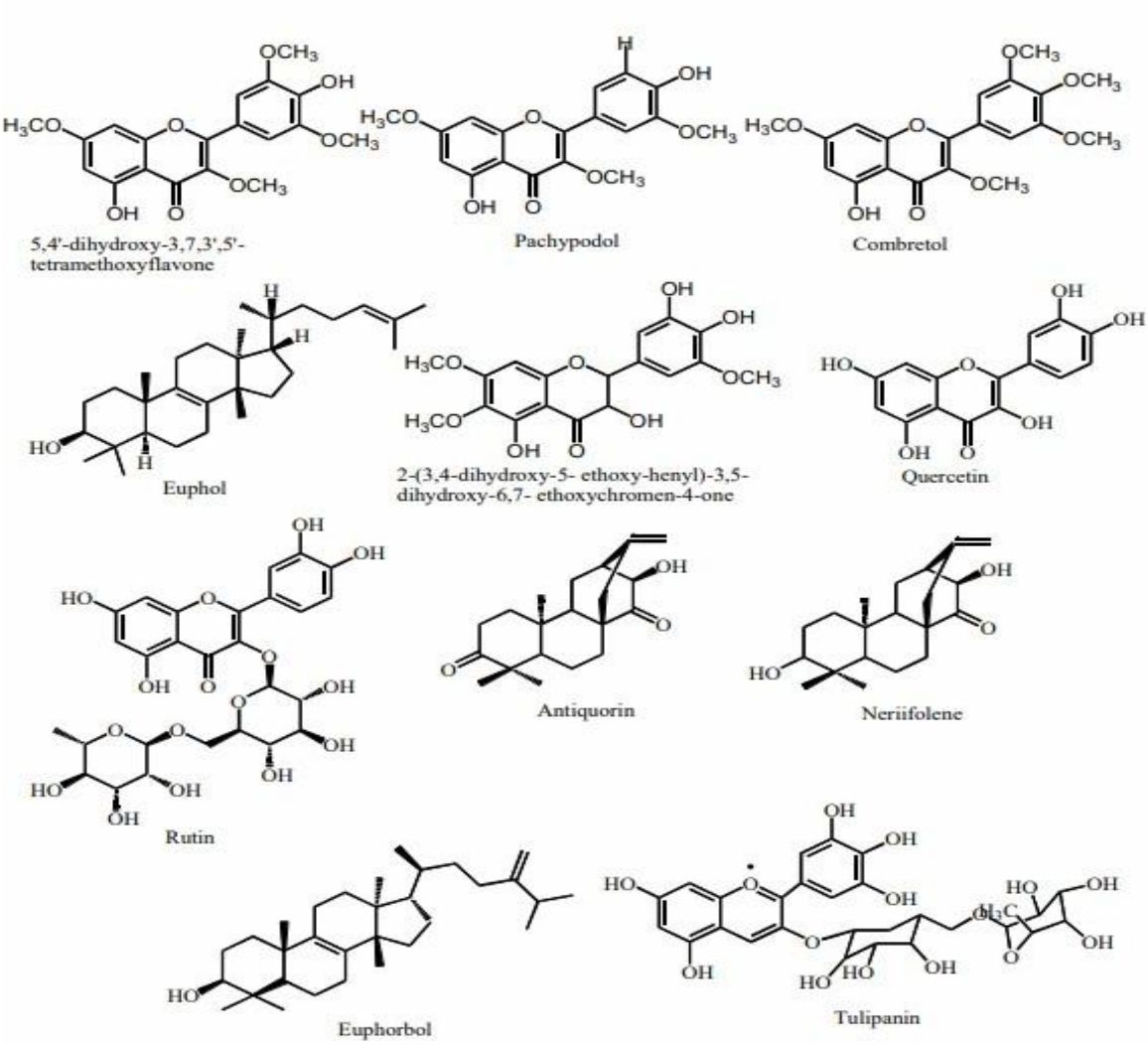
methylenecycloartenol, β-sitosterol, heptacosane, nnonacosane, shikmic acid, tinyatoxin, choline, camphol, and quercitol derivatives containing rhamnose and chtolphenolic acid.



Euphorbia neriifolia:

The presence of phytochemicals may vary in different parts of the plant. For example, anthraquinones are mainly present in the leaves, whereas lignin is found in the flowers [52–56]. Major characteristic phytoconstituents obtained from the plant are illustrated in Figure 2. Diterpenes and triterpenes are the major compounds obtained from Euphorbia species. A new tetracyclic triterpene nerifoliene, along with neriifoliol, nerifolione, euphol, etc., was isolated from the fresh latex of Euphorbia neriifolia. The whole diterpene and triterpene content of fresh E. Neriifolia latex was determined to be 24.50% and 16.23%, respectively [57]. Anjeneyulu et al. identified triterpenes in the leaf and stem of E. neriifolia. Separately, air-dried leaf and stem powders were extracted continuously with hexane, ether, and alcohol. Hexane extract, which is dark green in color, produces a colorless solid and a wax-like compound [58]. 24-methyl cycloartenol, euphol, euphorbol hexacozoate, 1- hexacosanol, 12-deoxy-4 phorbol-13-dodecanoate-20-acetate, tulipanin-3,5-diglucoside, and pelargonin-3,5-diglucoside were obtained from extracts of E. neriifolia bark in petroleum ether. Cycloartenol, 24-methylene cycloartenol, ingenol triacetate, euphorbol, 12-deoxyphorbol13,20-diacetate, tulipanin-3,5-diglucoside, and delphinidin-3,5-diglucoside were obtained in the petroleum ether extract of the root.





Pharmacological activity:

The genus *Euphorbia* is well known in ethnomedicine, and both *Euphorbia hirta* (commonly known as asthma weed) and *Euphorbia neriifolia* (commonly known as Indian spurge tree) have been traditionally used in Ayurveda, Siddha, and folk medicine. Despite differences in morphology and habitat, these two plants share several pharmacological activities, which have been validated by modern pharmacological studies.

Comparative Table: Common Pharmacological Activities of *Euphorbia hirta* and *Euphorbia neriifolia:*

Pharmacological Activity	Euphorbia hirta	Euphorbia neriifolia	Common Outcome
Antimicrobial	Effective against Gram+ and Gram– bacteria, mild antifungal activity	Strong antibacterial and antifungal effects (latex proteins)	Broad-spectrum antimicrobial potential
Anti-inflammatory	Flavonoids reduce COX/LOX pathways	Terpenoids and sterols reduce edema, arthritis	Potent anti-inflammatory activity
Antioxidant	Rich in flavonoids (quercetin, rutin)	Contains triterpenoids, sterols	Both scavenge free radicals and protect tissues
Anticancer	Ethanolic extracts show apoptosis in carcinoma cells	Latex and terpenoids cytotoxic to MCF-7, HepG2	Both show antiproliferative potential
Analgesic	Reduces writhing, pain response in animal models	Latex and alcoholic extracts show analgesic effect	Significant pain-relieving activity

1. Antimicrobial Activity:

Both plants exhibit broad-spectrum antimicrobial potential. Extracts of *E. hirta* (flavonoids, tannins, saponins) and *E. neriifolia* (triterpenoids, diterpenes, latex proteins) inhibit growth of Gram-positive bacteria like *Staphylococcus aureus* and Gram-negative bacteria like *E. coli* and *Pseudomonas aeruginosa*. They also show moderate antifungal effects against *Candida albicans*. This supports their traditional use in treating infectious diseases, wounds, and skin ailments.

2. Anti-inflammatory Activity:

Inflammation is a central target of both plants. *E. hirta* flavonoids (quercetin, kaempferol) inhibit cyclooxygenase and lipoxygenase pathways, reducing prostaglandins and leukotrienes. *E. neriifolia* contains terpenoids and sterols that show strong edema-reducing and anti-arthritic effects in experimental models. Both plants are used in folk medicine for respiratory inflammation (asthma, bronchitis), wounds, and rheumatic pain.

3. Antioxidant Activity:

Oxidative stress is a common pathway for several diseases. Extracts of both plants show significant free radical scavenging activity (DPPH, ABTS assays) due to phenolic and flavonoid content. *E. hirta* is particularly rich in flavonoids like rutin and gallic acid, while *E. neriifolia* contains triterpenoids and sterols with antioxidant properties. Their antioxidant activity supports protective effects in cardiovascular, hepatic, and neurodegenerative conditions.

4. Anticancer / Antiproliferative Activity:

Both plants demonstrate cytotoxic effects against cancer cell lines. *E. hirta* ethanolic extracts have shown apoptosis-inducing activity in human carcinoma cells. *E. neriifolia* latex and terpenoids have significant cytotoxic activity against breast cancer (MCF-7) and liver cancer (HepG2) cell lines. This justifies their inclusion in traditional anti-tumor remedies.

5. Analgesic Activity:

Both species show pain-relieving effects in experimental studies. *E. hirta* extracts significantly reduced acetic acid-induced writhing and tail-flick latency in mice. *E. neriifolia* latex and alcoholic extracts possess central and peripheral analgesic properties. Traditionally, both are used to relieve toothache, headache, and joint pain.

6. Immunomodulatory Activity:

Traditional use of these plants in respiratory infections and chronic illnesses is partly due to their ability to modulate the immune system. *E. hirta* polysaccharides and flavonoids stimulate macrophage activity and lymphocyte proliferation. *E. neriifolia* latex and triterpenoids exhibit immunostimulant properties by enhancing antibody production and phagocytosis.

7. Wound Healing Property:

Both plants are commonly applied to wounds and ulcers in folk medicine. *E. hirta* extracts enhance collagen synthesis, fibroblast proliferation, and wound contraction. *E. neriifolia* latex forms a protective layer over wounds and promotes faster epithelialization. Their antimicrobial and antioxidant properties further support wound healing effects.

Activity	Euphorbia hirta	Euphorbia neriifolia
Antioxidant	Ethanol/EA extracts show strong radical-scavenging activity (DPPH IC ≈ 0.205 mg/mL; EA IC ≈ 10 µg/mL)	Leaf and saponin extracts exhibit potent free-radical scavenging; protective enzyme restoration in liver/kidney models
Anti-inflammatory	Reduced NO production in macrophages; downregulation of NF-κB, COX-2, TNF-α, IL-6 in inflammatory models	Leaf and latex extracts show greater effect than indomethacin/diclofenac; traditional use in inflammatory disorders
Antimicrobial	EA extract effective vs Gram-positive/-negative; traditional antimicrobial use	Latex and leaf extracts active against E. coli, S. aureus, P. aeruginosa; traditional antiseptic applications
Anticancer / Cytotoxic	EA and methanol extracts cytotoxic to lung, colon, liver cancer cells; induced apoptosis via caspase-3	Ethyl acetate extract cytotoxic to lung, melanoma, colon cancer cell lines; leaf extract anticancer attributes in vivo
Analgesic	(Not directly cited, but traditional analgesic use	Hydroalcoholic leaf extract analgesic; traditional use of

	reported)	latex for pain
Immunomodulatory	(Implied via NO modulation and inflammation control)	Leaf extract enhances immune indices in sepsis model; traditional immunostimulant roles
Wound healing	(Not directly cited here for *E. hirta*)	Latex aqueous extract improves wound tensile strength, epithelialization, and angiogenesis
Additional Activities	Anxiolytic, antiviral, antidiabetic, antistress, antimalarial, antidiarrhoeal	Anti-diabetic, hepatoprotective, radioprotective, anti-arthritic, anticonvulsant, anti-psychotic, diuretic, etc.

Conclusion:

The comparative analysis of *Euphorbia hirta* and *Euphorbia neriifolia* reveals significant common pharmacological activities, including antimicrobial, anti-inflammatory, antioxidant, analgesic, immunomodulatory, wound-healing, and anticancer effects. These activities are strongly correlated with their rich phytochemical content, primarily flavonoids, tannins, terpenoids, and sterols. Although preclinical studies provide promising evidence, clinical validation remains insufficient. Standardized extraction protocols, toxicity studies, and well-designed clinical trials are crucial for translating these findings into therapeutic applications. Further exploration of molecular mechanisms, synergistic effects, and nano-formulation approaches could enhance their pharmacological efficacy and safety. In conclusion, *E. hirta* and *E. neriifolia* are valuable medicinal plants with overlapping pharmacological activities that bridge ethnomedicine and modern pharmacology. Their potential as natural, affordable, and multi-target therapeutics highlights the need for continued scientific investigation and pharmaceutical development.

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