

Botanical Description, Phytochemical Constituents and Pharmacological Properties of *Euphorbia hirta* Linn: A Review

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ABSTRACT

Ethnomedicines are now an important area of better treatment in many countries of the world. *Euphorbia hirta* Linn. (Family- Euphorbiaceae) an annual medicinal weed and it is commonly known as Asthma plant. It is not only a weed, but also it is a medicinal herb, too. These medicinal herbs are found in tropical and temperate parts of the world along with India, Bangladesh, Africa, and Australia. Extensive literature studies suggested that the various parts of the plant are reported to possess anti-microbial, anti-diabetic, anti-cancer, anti-tumor, anti-plasmodial, anti-fertility, wound healing, anti-inflammatory, sedative, and diuretic properties.

The present review study deals with the botanical description, phytochemical, pharmacological, therapeutic, nutritional and other important biological aspects of *Euphorbia hirta*. The main phytochemicals found in this plant are polyphenols, flavonoids, steroids, tannins, and alkaloids. This review study may be utilized for the identification and preparation of a monograph of *Euphorbia hirta*.

Keywords: *Euphorbia hirta*, Bioactive Compounds, Phytomedicine, Medicinal Weed

INTRODUCTION

In present days' society, the most accepted and recognized form of medicine is herbal medicine in the whole world. The plant produces various secondary metabolites which are bio-synthetically derived from primary metabolites, and these compounds are the main source of herbal pharmaceutical products. [1-3] The medicinal and nutritional importance of plants lies in different phytochemical components that have a particular physiological action on the human body. [4] According to the World Health Organization, a huge number of populations presently use phytomedicine for

development of healthcare. Human beings are using various parts of plants to produce medicine; these are working as a panacea for modern civilization [2,3,5] For the treatment and prevention of many diseases, various medicinal plants would be the best source to obtain quality herbal drugs. Therefore, such medicinal plants should be investigated properly to a better understanding of their botanical attribute such as morphology, anatomy or physiology and or to know the chemical properties, safety, and efficacy. [6]

Euphorbia hirta has the characteristic of allomorphic pistillate flowers and fruits. [5] These are annual, bushy, soft-woody small herb with a thin brownish gray bark, leaves palmately or serrated, lobed flowers are in terminally arranged male flowers on the upper half of the inflorescence and the pistillate at the basal half, fruits globose, dehiscent, it is green and covered with fleshy prickles, seed oblong with smooth, hard, mottled crustaceous testa with a white caruncle at the top enclosing oily endosperm. [7]

Euphorbia hirta has a worldwide distribution, and its common names include asthma weed and milk weed. Its local name in West Bengal and Bangladesh is "Boro Keruie". It is distributed throughout the temperate or tropical parts of India, Asia, Australia, and Africa, often found in lowland, paddy fields, gardens, waste places, and in the roadsides. They prefer dry and humid condition, from sea-level up to 2200 m altitude. It is native to Central America. [2, 3, 8-11] It is a weed considered as beneficial for its diverse application in traditional medicine system. Phytopharmacological investigations showed that its bioactive components possessed various pharmacological properties like anti-inflammatory, anti-microbial, anti-diarrheal, sedative, analgesic, anti-pyretic, anti-oxidant, anti-asthmatic, anti-tumor, larvicidal, diuretic, etc. [12] It is extensively used traditionally to cure and prevent gastro-intestinal disorders, affections of mucous membranes, and respiratory system disorders. [13] *Euphorbia hirta* has huge economical importance in Nigeria. The cold extract of the leaves is used to bath small babies with skin infections. It is used ethnomedicinally for female disorders. According to many ethnomedicinal kinds of literature the plant has known for increasing milk flow in women, and because of its milky latex, it is also used for different female disorders. [1, 9, 10, 14] It also reported that the plant is used as anti-spasmodic, anti-diabetic, anti-inflammatory, anti-cancer curative agent. [15]

In Africa, the decoctions of the plants are used in the treatment of lung disorders. It is used for cold, fever, coughs, bronchitis and lung disorders in Malagasy. *Euphorbia hirta* is also used in Angola as anti-diarrheal and amoebic anti-dysenteries diseases. The extract of the plants are also used in ear infections and the treatment of boils, sore, and it promotes the wound healing processes. [16] In India, the plant parts are traditionally used to treat against worm infestations in babies and for dysentery, gonorrhoea, jaundice, acne, pimples, digestive disorders, cancer, diabetes and for different tumors. [17] The extracts of the root are used against vomiting, diarrheas and also for snake bite as anti-venom. [18] In Africa and Australia, the leaf extracts are used to treat hypertension and inflammations. The chemical compositions of *Euphorbia hirta* along with its pharmacological properties have been investigated by many researchers. Flavonoids, steroids, terpenoids, coumarins, tannins, and polyphenols were isolated, characterized and identified as the main compounds of the plant. [10,14-18] In the current review, comprehensive knowledge and information about *Euphorbia hirta* are represented for the study of its morphological, ethnopharmacological, phytochemical and toxicological areas.

TAXONOMICAL CLASSIFICATION

Kingdom: Plantae

Division: Tracheophyta

Class: Magnoliopsida

Order: Malpighiales

Family: Euphorbiaceae

Genus: *Euphorbia*

Species: *Euphorbia hirta*

Botanical Name: *Euphorbia hirta* Linn.

Common Name: Asthma Plant (English), Boro Keruie (Bengali) (Fig. 1)

Synonym: *Euphorbia capitata* Lam., *Euphorbia pilulifera* Jacq., *Chamaesyce hirta* (L.) Millsp. [1,9]

Euphorbia hirta has many local names in different countries such as in China:

Feiyangcao, Arab: Labeinah, Malaysia: Ambin jantan, English: Asthma plant, Indonesia: Daun biji kacang, Malay: Moluccas, Sundan: Nanangkaan, Papua New Guinea: Sip, New Britain: Gunantuna, Philippines: Botobotonis, Laos: Mouk may, Thailand: Nam nom raatchasee, Vietnam: Corsuwxra, French: Euphorbea fleusentete, India: Dudhi, West Bengal and Bangladesh: Boro Keruie, Japan: Gelang Susu, Norway: Demba sindji, Australia: Asthma herb, Liberia: Tuagbono. [1, 9, 10]



Fig1. The Plant of *Euphorbia hirta* Linn.

BOTANICAL DETAILING

Euphorbia hirta is a small annual, branched prostrate herb (Fig.1) with branches reaching 60 cm in height, reddish or purple, with abundant latex and is hairy.



Fig.2: Plant



Fig.3: Leaves

Leaves: Leaves are opposite, distichously, and simple; stipules are linear. The leaf blades are lanceolate-oblong, serrated, long elliptic, or obovate or ovate-lanceolate; its base is very dissimilar or unequal; one side is cuneate, the other side is obliquely rounded; the apex is acute, length is 3-4 cm and width is 1-1.4 cm. and its margins are smooth toothed, sometimes with a purple

blotch near the midrib (Fig.2, Fig.3, and Fig.4).



Fig.4: Inflorescence and Flowers

Flowers: The inflorescence of *Euphorbia hirta* has a monoecious, terminal or axillary cluster of flowers, called as 'cyathium', and with several cyathia finely arranged into a cyme (Fig.4). The male and female flowers are condensed in one involucre and both apetalate. The flowers are unisexual; the male flowers are sessile, the bracteoles are linear, fringed, the perianth is absent, and possesses 1-stamen, the female flowers have small pedicel, the perianth is rimmed, the ovary is superior, covered with minute hairs, 3-celled, possesses 3-styles, small, and the apex is 2-fold. Flowering duration is usually throughout the year.

Stem: The stems (Fig.5) are small, glabrous, hairy and long with monopodial branching pattern. Internodes are 2.5 to 3 cm in length, stipules present, covered with pubescent.



Fig.5: Stem

Fruit: *Euphorbia hirta* has allomorphic pistillate fruits. The fruit is exerted, 3-lobed, base truncate, covered with short hairs. The seeds are oblong, 4-sided prismatic, wrinkled and brownish pink, 3-seeded capsule; it is green and covered with fleshy prickles, seed smooth, hard, mottle

crustaceous testa with a white caruncle at the top enclosing oily endosperm.

Root: It has a distinct and developed primary root i.e. tap root system (Fig.6). [1, 2, 8-10, 19, 20]



Fig.6: Root

PHARMAPHYTOCHEMISTRY

Phytochemistry is the branch of chemistry, deals with chemical properties of the plant or plant-derived products. It is also known as the chemistry of natural products. Phytotherapy acts as a source of treating and prevention of many diseases by using the bioactive compounds which are secondary metabolites of medicinal plants. [2, 3, 20]

Euphorbia hirta has a diverse amount of bioactive components such as polyphenols, anti-oxidants, ascorbic acids, anthocyanins, flavonoids, terpenoids, volatile oil, etc. The plant has been studied by various researchers and some bioactive components have been isolated and characterized. Phytochemical analysis of leaf extract showed the presence of carbohydrates, reducing sugars, terpenoids, alkaloids, steroids, tannins, proteins, fats, oils, mucilages, glycoside, saponin, coumarin, anthroquinones, chlorophyll, and carotenoids. Flavonoids compounds like quercetin, quercitrin, quercitol and its derivatives such as rhamnose, quercetin rhamnoside, chlorophenolic acid, rutin, leucocyanidin, myricitrin, cyaniding 3,5-diglucoside, camphol, flavonol, inositol, tetraxerol, β -sitosterol, and kaempferol are found in *Euphorbia hirta*. Afzelin, euphorbin-A, euphorbin-B, euphorbin-C, euphorbin-D, gallic acid, and protocatechuic acid were also isolated from the aerial parts of the plants. [4,9,21-23] Terpenoids such as α -

amyrin, β -amyrin, cycloartenol, euphorbol hexacosonate, taraxerone, taxerol, β -amyrin acetate and diterpene such as 12-deoxy phorbol-13-phenyl acetate-20-acetate, ingenol triacetate and phytosterols such as campesterol, cholesterol and stigmasterol are also present. Tannin categories of compound such as dimeric hydrolysable dehydro ellagic tannins, and terchebin, the monomeric hydrolysable tannins geranin and benzyl gallate etc are found in this plant. [10,24] Acids categories of compound like Ellagic, gallic, tannic, maleic and tartaric acids are present in this plant. Different essential oil compounds are also present in *Euphorbia hirta*. Compounds like epigallocatechin gallate, epicatechin gallate, chlorogenic and caffeic acids, and sterols, brassicasterol were also isolated. [19, 25-28]

Other compounds such as Alkaloids, saponins, protein, amino acid, and minerals are also present in these plants. Total polyphenolic and flavonoids content of various parts of the plant were examined. Leaves extract showed the highest total phenolic content (206.17 ± 1.95) mg GAE/g dry weight. The leaves also had the highest total flavonoids content value (37.970 ± 0.003) mg CE/g dry weight. Mineral compositions of dried leaves of this plant were studied and it was like Ca: 1.1%, P: 0.3%, Fe: 0.03%, Mg: 0.5%, Mn: 0.01%, Zn: 0.01% and Cu: 0.002%. [1, 29-31]

Ghosh et al. (2018) investigated the plant pigments of *Euphorbia hirta* along with other Indian traditional medicinal plants. Research investigations found that total carotenoids concentration was 1.545 mg/g tissue and the amount is third highest among other herbs. Total chlorophyll concentration was 3.052 mg/g tissue in this plant, and it is second highest among other medicinal herbs. Chlorophyll b content is highest and chlorophyll content is second highest comparing with other herbaceous plants. Other two different research studies of Ghosh et al. (2018) found that these plant pigments may vary with the major environmental or ecological factors like air

pollution and it may vary with different seasonal changes as well. [2, 3, 32-34]

PROXIMATE CHARACTERISTICS

Euphorbia hirta exhibits following proximate characteristics such as total ash content 8.90, acid insoluble ash 7.84, water-soluble ash 1.06, water-soluble extract 7.0, ethanol soluble extract 14.85, methanol soluble extract 9.71 and moisture content 9.84 (% w/w). The physicochemical properties of the plant had shown various contents, and it is like lipid of the leaves 25.0 and stems 14.0 (%w/w), carbohydrate of the leaves 1.5 and stems 8.0 (%w/w), protein of the leaves 9.5 and stems 3.0 (%w/w), ash of leaves 18.66 and stems 21.50 (%w/w), acid-insoluble ash of the leaves 3.50 and stems 2.50 (%w/w), and the moisture content of leaves 13.50 and stems 10.30 (% w/w), respectively. [1, 4, 21, 22]

ETHNOPHARMACOLOGICAL PROPERTIES

Euphorbia hirta has a long history as a medicinal herb in the whole world. Various pharmacological formulations are used such as crude extracts, juice, decoction, infusion and dried powders. It is used in ethnomedicine because of its wide range of biological and pharmacological activities. *Euphorbia hirta* was recorded in Chinese Pharmacopoeia (1977). The crude extracts of the whole plant also used as veterinary medicine for treating esenteritis, diarrhea in pig, cattle, horse, sheep and fish in folklore medicine. It is also applied to cure gonorrhea and hematuria. It is included in the African pharmacopeia for different medications. In South Africa, it is commonly used to treat asthma. [35] In the Gold Coast, the plant is used to cure enema for constipation. In Indian folklore medicinal systems, the leaves are used in the treatment of cough, cold, fever, asthma, bronchial infections, bowel complaints, helminths infestations, wound healing, kidney stones, and syphilis. The latex is used to treat conjunctivitis and ulcers. *Euphorbia hirta* is used to increase milk

flow to nursing mothers. In the Philippines, leaves of the plant are mixed with *Datura metel* leaves and petals for preparing the asthma-cigarettes. [1, 9, 10, 17-20]

Anti-allergic, Analgesic and Anti-anaphylactic Property

The ethanol extract of *Euphorbia hirta* was showed significant anti-anaphylactic properties. The plant has inhibited passive cutaneous anaphylaxis in rat and active paw anaphylaxis in mice in a research investigation. The ethanol extract possessed prominent activity to prevent early and late phase of allergic reactions caused by anti-histaminic, anti-inflammatory, and immune-suppressive properties. [36, 37]

Anti-diarrheal and Spasmogenic Property

The water extract of the plant is prominently and dose-dependently decreased the gastro-intestinal motility in normal rats and decreased the effect of castor oil-induced diarrhea in mice. [38] The water extract of *Euphorbia hirta* exhibited anti-diarrheal, anti-microbial, anti-amoebic, and anti-tetanic properties. A study discussed the contractile activity of the total aqueous extract of leaves in rats. The result concluded that water extracts had spasmogenic activity in vitro and anti-diarrheal activity in vivo. [39]

Anti-inflammatory Property

A research study showed that the water extracts of *Euphorbia hirta* had prominent and dose-dependent anti-inflammatory activities in carrageenan-induced edema test in rats from a dose of 100 mg/kg body weight. The petroleum ether, chloroform, methanolic, ethanolic and water fruit extracts were tested for anti-inflammatory activity. The water and ethanolic decoctions showed a maximum percentage of protection for inflammation compared to other decoctions. [1, 12, 35]

Diuretic Property

Research investigation showed that the ethanol and water extracts of the leaf of *Euphorbia hirta* could significantly effect on diuresis in an animal model. It increased

urine output and electrolytes. The investigations showed that the active components in the aqueous extract of the leaf had similar diuretic effect as that of acetazolamide. [40]

Anti-oxidant Property

The methanolic and aqueous extracts of the plant parts showed anti-oxidant properties which are comparable to green and black teas. A research study showed that the phenolic acids have synergistic interaction with BSA, and their anti-oxidant effect was showed to be enhanced after incubation with BSA up to 20%. Water infusions showed an anti-oxidant activity and free radical scavenging properties in different in vitro models, such as ferric reducing power determination, free radical-scavenging effects using ABTS, DPPH, and hydroxyl radical scavenging assays. The free radical inhibition on hydroxyl and DPPH was 73.36 ± 5.21 and $68.80 \pm 5.21\%$, respectively. [41] The free radical scavenging effect of ethanol and petroleum ether decoctions of the plant was also demonstrated through various in vitro anti-oxidant assays, such as DPPH free radical scavenging, superoxide anion radical scavenging, and NO scavenging and reducing power activity. [23] The anti-oxidant activity from different parts (leaves, stems, roots, and flowers) has been studied and the results concluded that the leaves extract showed a maximum DPPH scavenging activity of 72% followed by the other plant parts scavenging effects. Leaves decoction had the highest total polyphenolics and total flavonoids content, followed by the flower, root, and stem extracts. [42]

Anti-tumor Property

Anti-tumor properties of the leaves of *Euphorbia hirta* was examined against EL-4 cell line in the animal model. A prominent increase of mean survival time and reduction of solid tumor mass of EF-treated tumor-bearing animal was found. [43] The methanolic decoctions of the leaves of the plant on Hep-2 cells from human

epithelioma of the larynx showed anti-proliferative activity. [44]

Anti-diabetic Property

Anti-diabetic properties of the ethanolic and ethyl acetate extracts of the plant were examined in vitro mode using the α -glucosidase inhibitor method and concluded by in vivo oral glucose tolerance test using various loading methods. Several processes involved in the method, such as anti-oxidant effect, α -glucosidase inhibitory effect, and increasing the activity of insulin release from β cells of the Langerhans islets. Research investigations of ethanol extracts of leaf, flower, and stem of *Euphorbia hirta* on streptozotocin-induced diabetic mice showed a prominent reduction in blood glucose levels. The ethanol and petroleum ether decoctions of the flower were also demonstrated potential anti-diabetic activities in the alloxan-induced diabetic animal. The ethanol extract showed a significant decreased in blood glucose level on alloxan-induced diabetic rats. From the in vitro investigations, ethanol extract and ethyl acetate fractions had shown α -glucosidase inhibition property, while n-hexane, chloroform, butanol, and aqueous fractions had no α -glucosidase inhibitory effect. In vivo experiment also had the same result. [45-49]

Anxiolytic and Sedative Effect

The hydroalcoholic extract of the plant was investigated for anxiolytic effects in chronically stressed rats, and it was observed in two different stressors: Chronic immobilization stresses (CIS) and forced swim stress (FSS). The findings demonstrate the anxiolytic potential of *Euphorbia hirta*, particularly in CIS induced anxiety. Another study showed the behavioral effects of the extract in mice. Lyophilised water extract does not show any mortality when administered orally. [50, 51]

Anti-hypertensive / ACE inhibition Effect

The research study concluded that the extract of the plant parts inhibited the activity of the angiotensin-converting enzyme (ACE). [52, 53]

Immunomodulatory Property

The plant extract has been reported to have 45% immunomodulation properties through the inhibition of NO production. A study concluded the in vitro and in vivo immunomodulatory properties of the plant which has been proven through macrophage effect testing, carbon clearance method, and mast cell de-granulation assay. [54-56]

Anti-arthritis Property

A research investigation was done to observe the anti-arthritis properties in an animal model. The results suggest that *Euphorbia hirta* has improved adjuvant-induced arthritis. [57]

Anti-thrombocytopenic Property

Anti-thrombocytopenic effects of lyophilized extracts of the plant were examined in Sprague-Dawley rats. Ethanolic extracts induced thrombocytopenia within seven days in rats. A prominently increased platelet count decreased bleeding and clotting time was shown after the treatment. [58]

Gastro-intestinal Tract Effect

A research study was carried out to investigate the gastro-intestinal motility in animals. Results showed that water extract of leaves was significantly and dose-dependently decreased gastro-intestinal motility in rats and Castrol oil-induced diarrhea in mice. [38]

Wound healing Property

A study was done to observe anti-bacterial activity and tissue reaction of ethanolic decoction of the plant in infected canine wounds. The ethanolic extract had a positive effect on *Staphylococcus aureus* growth in the canine wound, but the extract had not provoked cutaneous tissue reaction in canine wounds. [59] Another study showed that ethanolic extract of the whole plant in animals has significant burn wound healing properties. [60]

Sperm Motility Effect

A research study utilized sexually matured and healthy West African Dwarf rams. The result indicates that fertilization capacity and livability of spermatozoa were negatively affected. [61]

Genoto-toxic Effect

Research investigation showed that genoto-toxic activities of methanolic extract using *Allium cepa* test. Result concluded that *Euphorbia hirta* methanolic extract (1mg/ml) exhibited prominent genoto-toxic and mitodepressive properties. [62]

Synergistic Property

A study was done to determine in vitro activity of erythromycin, and *Euphorbia hirta* leaves methanolic decoctions in combination against *Staphylococcus aureus*. The results showed that some combination of *Euphorbia hirta* leaves and erythromycin resulted in synergistic effects. [63]

Effect on CNS

A research study examined water extract of the plant for benzodiazepine-like properties, hypnotic, neuroleptic and anti-depressant effects. The plant extract caused a direct action on the central nervous system and a minimum anti-depressant property. [64]

Effect on Asthma

A study made a comparative ultra-structural analysis in an animal model. Ultra-structure of fibrin networks and platelets of control mice compared with asthmatic mice and it was treated with two concentrations of hydrocortisone, and one concentration of plant material and the study showed positive results. [35]

Anti-microbial and Anti-fungal Property

Anti-bacterial activity was attributed to polyphenols, tannins, flavonoids, alkaloids, glycosides, proteins, sterols, polysaccharides and saponins, etc. Ethanol extract of *Euphorbia hirta* also showed marked anti-microbial properties against the growth of *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Bacillus subtilis*. A study compared the anti-bacterial capability of the methanol, hexane, and water extract in *Escherichia coli*, *Klebsiella pneumoniae*. The results concluded that the aqueous decoctions provided more anti-microbial properties than organic solvent decoctions. Leaves extract regulated the growth of all examined

microbes with large zones of inhibition. [59, 63-71]

Anti-viral Property

In vitro anti-retroviral properties of water and methanolic decoctions of the plant were compared against SIVmac251, HIV-1 and HIV-2 viruses on MT4 human T lymphocyte cell line. 50% methanolic decoctions showed a high anti-retroviral activity than water extract, and it was mainly due to the presence of active component tannin. [72]

Anthelmintic, Molluscicidal and Larvicidal Property

The water extract of the plant reduced the fecal egg count of the helminths in Nigerian dogs and exhibited potentiality as an anthelmintic agent. The study highlighted the larvicidal activity of *Euphorbia hirta* against the third instar larvae of *Anopheles stephensi*, the urban malaria vector. The latex was considered as a plant-derived molluscicide agent against snails. [73-75]

Anti-malarial Property

In a research study isolated flavonol glycosides afzelin, quercetin, and myricitrin showed inhibition of the proliferation of *Plasmodium falciparum*. [76]

Anti-molluscicidal Property

Potent molluscicidal activity of *Euphorbia hirta* was studied by researchers, and it showed time and dose-dependent molluscicidal activity. [75]

Herbicidal Property

A research study was done to observe the activity of *Euphorbia hirta* on germination and seedling growth of groundnut. Higher concentration prominently regulated the germination than lower concentration. A significant decrease in root and shoot length of groundnut was found in *Euphorbia hirta* infested soil. [77]

Corrosive Property

A study was done to observe the corrosion inhibition effect of the plants. A gravimetric technique was used for the study. [78]

Aflatoxin inhibition Property

A research study found that water decoction of the plant prominently inhibited aflatoxin production on rice, wheat, maize and groundnut. [79]

Anti-cancer Property

Brine shrimp lethality test was used to investigate the cytotoxicity of *Euphorbia hirta*. The study concluded that the LC₅₀ of ethyl acetate and acetone decoction of plant parts were 71.15 and 92.15 µg/ml, respectively. [80] Another study showed that flavonol glycosides (afzelin, quercitrin, and myricitrin) was isolated and characterized from the methanol decoction of the leaf and stem of the plant and it was showed a slight cytotoxic effect against human epidermoid carcinoma KB 3-1 cells. [81] The leaves decoction of the plant also showed toxicity based on the viability of the cells by in vitro screening on the lymphocytes from the blood cells. [82]

Water Consumption Property

The activity of the plant decoction was examined in an animal model. Intraperitoneal administration of 10 mg/100 kg b.w. of the decoction significantly ($P < 0.05$) decreased the amount of water consumed by the animals, and the activity lasted for two h. [53]

Hepato-protective Property

Anti-hepatotoxic property of hydroalcoholic decoction of the plant was investigated in animal models of liver injury in animals induced by CCl₄ or paracetamol. The serum levels of animals were given the extracts (125 and 250 mg/kg) were significantly lower ($P < 0.05$ and 0.01, respectively) than CCl₄ or paracetamol-injured animals. [83, 84]

Galactogenic Property

The dried plant powdered was given to female guinea pigs before puberty, and the study showed that it increased the development of the mammary glands and induced milk flow. [85]

Anti-fertility Property

The plant extract at a dose level of 50 mg/kg body weight was reduced the sperm motility and density of cauda epididymal and testis sperm suspension

prominently and it was leading to 100% infertility. [86]

Anti-venom Property

A research study showed that the methanol extract of the plant inhibited the venom enzymes under the in vitro conditions. The content of polyphenols was found quite high such as ellagic acid, quinic acid, and gallic acid. These bioactive components can inhibit venom proteases. [87]

TOXICOLOGY

Euphorbia hirta has been used in folklore medicine from ancient time. The research investigations of the toxicity and safety evaluations of the plant have been lacking, and only a few reports of target organ toxicity or side effects have been cited in previous literature. The water extracts were administered orally to a 38-week old mature male at the dose of 400 mg/kg to show the activity of the decoctions on the male reproductive organs. The results showed that the decoction caused varying doses of testicular degeneration reduction in the mean seminiferous tubular diameter in the tested animals. [10, 88] The LC₅₀ of ethyl acetate, acetone extract of *Euphorbia hirta* and methanolic extract of *Euphorbia nerifolia* were determined 71.15, 92.15 and 49.55 µg/ml, respectively. Among these two plants, the most active extract was a methanolic extract of *Euphorbia nerifolia*. [43] The sub-lethal doses of the decoction altered the levels of protein, free amino acid, nucleic acids and the property of enzyme proteases, acid, and alkaline phosphatases in different tissues of the vector snail *Lymnaea acuminata* in time and dose-dependent patterns. [75] Another investigation was carried out to determine the toxicity of the plant decoction. The results concluded that all the parts of the plants except the flower had LC₅₀ values of almost 1 mg/ml. [44, 70] A research study was done to observe the efficacy of binary and tertiary combinations of *Euphorbia hirta* latex dried portions with other active compounds like rutin, ellagic acids, teraxerol, and betulin. Toxic effect of the latex and active compounds were used

against fresh water snails *Lymnaea acuminata* and *Indoplanorbis exustus* in the pond. Along with snails, fish *Channa punctatus* was also lethal to high dose, while LC₉₀ does not have killing effects in fish. [80]

The acute and sub-chronic oral toxicity of methanolic extract of the plant at a single dose of 5000 mg/kg did not produce any symptoms of toxicity in the animals. The LD₅₀ was estimated to be more than 5000 mg/kg. In the repeated dose 90-day oral toxicity investigation study, the administration of 50 mg/kg, 250 mg/kg and 1000 mg/kg/day of the plant extract revealed no significant difference ($P > 0.05$) compared to the control group and that did not cause sub-chronic toxic effects. Ethanol extract of the plant was examined in animals. Animals were given 200 mg/kg, 400 mg/kg and 600 mg/kg of ethanolic extract for 14 days. The results concluded that the plant was caused a significant increase ($P < 0.05$) in RBC, WBC, PLT, Hb and PCV level while there was a reduction in lymphocytes. *Euphorbia hirta* extract caused a significant decrease ($P < 0.05$) in serum lipid profile when it was compared to normal controlled animals. There was a little increase in the levels of ALT and AST properties in the treated group when compared with the controlled group. [89, 90]

CONCLUSION

Euphorbia hirta Linn. has a wide range of potentiality for morphological, phytochemical, pharmacological, pharmaceutical, therapeutic and nutritional properties. From the above course of review and detail explanation, it can be concluded that *Euphorbia hirta* Linn. has been used as an important medicinal, therapeutic and nutritional source for many severe diseases in various parts of the world and it has been concisely discussed in the present review article. The review showed the different traditional uses, morphological and other important biological corners of *Euphorbia hirta* Linn. The toxicity studies also discussed in the article.

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Conflict Of Interest

The author declares no conflict of interest.

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