

# A Review on Pharmacological and Chemical Documentation of *Euphorbia Hirta* Linn (Asthama Herb)

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## ABSTRACT

Ayurveda, an orthodox as well as main stream system of medicine has been with a source of new concepts and products for healthcare. *Euphorbia hirta* Linn. (EH) is an advantageously authenticated medicinal plant as observable from the literature. Rural and tribal people of India use different parts of this plant to surmount various diseases. Its use in traditional medicine has been assured on scientific basis by studying pharmacology of the plant in vitro and in vivo. Information was collected from different data base resources.

**Key words:** Asthma herb, Dudhia, *Euphorbia hirta*

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## INTRODUCTION

In India, used of the different parts of several medicinal plants to cure specific diseases has been in practice from ancient times. The indigenous system of medicine namely Ayurveda, Siddha, and Unani, has been in existence for several centuries. Some drugs from Ayurveda approaches modern diseases, had already reached the market place.<sup>1</sup> In

modern medicines, plants occupy a very important place as the raw material for some important drugs. Synthetic drugs are effective in controlling different diseases but these synthetic drugs are out of reach of millions of people and have various side effects. It is estimated that around 70,000 plant species have been used for medicinal purposes. The herbs provide the starting material for the synthesis of conventional drugs. India recognizes more than 2500 plant species having medicinal value, Sri Lanka around 1400 and Nepal around 700.<sup>2</sup> This review intends to provide an overview of the chemical constituents and pharmacological actions of *Euphorbia hirta*.

## METHODS

For literature survey we used various search engine like Google scholar, Science direct and Pubmed. The present review gives complete information on the pharmacological activities and chemical constituents of this plant mentioned from the year as back as 1963 to the latest December 2014 and it includes 37 references.

## Distribution and habitat

*Euphorbia hirta* is distributed throughout the hotter parts of India and Australia, frequently found in waste places along the roadsides.<sup>3</sup>

## Plant Description

*E. hirta* Linn. Syn- *E. pilulifera* Linn.

*Chamaesyce pilulifera* Linn [4].

Family: *Euphorbiaceae*

Vernacular Names

Bengal- Barokhervi

English -bearing spurge, asthma herb, snakeweed

Gujarat- Dudeli

Hindi- Dudhi

Nepali-Dudhia

Indonesia- Daun biji kacang

Malayalam- Nelapalai

Malaysia -Ambin janyan

Marathi- Dudnali, govardhan

Orissa- Jhotikhuntia Sanskrit

Tamil- Amumpatchaiyarissi

Telagu- Reddinanabrolu

## Morphology



## Scientific classification

Kingdom	- Plantae
	Angiosperms
	Eudicots
	Rosids
Order	- Malpighiales
Family	- Euphorbiaceae
Genus	- <i>Euphorbia</i>
Species	- <i>E. hirta</i>
Binomial name	- <i>Euphorbia hirta</i> L.
Synonyms	- <i>Chamaesyce hirta</i> (L.) Millsp

It is a slender- stemmed, annual hairy plant with many branches from the base to top, spreading up

to 40 cm in height, reddish or purplish in color. Leaves are opposite, elliptic-oblong to oblong-lanceolate, acute or sub-acute, dark green above; pale beneath, 1- 2.5 cm long, blotched with purple in the middle, and toothed at the edge. The fruits are yellow, three-celled, hairy, keeled capsules, 1-2 mm in diameter, containing three brown, four-sided, angular, wrinkled seeds.<sup>1,2</sup>

## Therapeutic applications

*E. hirta* is used in the treatment of gastrointestinal disorders (e.g. diarrhea, dysentery, intestinal parasitosis), bronchial and respiratory diseases (e.g. asthma, bronchitis, hay fever), and in conjunctivitis. Hypotensive and tonic properties are also reported in *E. hirta*. The aqueous extract exhibits anxiolytic, analgesic, antipyretic, and anti-inflammatory activities. The stem sap is used in the treatment of eyelid styes and a leaf poultice is used on swelling and boils.<sup>5</sup>

Extracts of *E. hirta* have been found to show anticancer activity. The aqueous extract of the herb strongly reduced the release of prostaglandins I<sub>2</sub>, E<sub>2</sub>, and D<sub>2</sub>.<sup>5</sup> The aqueous extract also inhibits aflatoxin contamination in rice, wheat, maize, and mustard crops.<sup>6</sup> Methanolic extract of leaves have antifungal and antibacterial activities. The leaves pounded with turmeric and coconut oil are warmed and rubbed on itchy soles. The latex of *E. hirta* is applied on lower eyelids, like *surma* to cure eye sores. The root exudates exhibit nematicidal activity against juveniles of *meloidogyne incognita*.<sup>7</sup>

Decoction of dry herbs is used for skin diseases. Decoction of fresh herbs is used as gargle for the treatment of thrush. Root decoction is also beneficial for nursing mothers deficient in milk. Roots are also used for snake bites.<sup>1</sup> The polyphenolic extract of *E. hirta* has antiamebic and antispasmodic activities.<sup>8</sup> Quercitrin, a flavanoid glycoside, isolated from the herb showed an antidiarrheal activity.<sup>9</sup> It is reported to have a relaxation effect on respiration. The alcoholic extract of whole plant shows hypoglycemic activity in rats.<sup>5</sup> It has a sedative effect on the genito-urinary tract.<sup>3</sup>

## PHARMACOLOGICAL ACTIVITIES

Herbal medicines have become an integral part of standard healthcare, based on a combination of time honored usage and outgoing scientific

research. Burgeoning interest in medicinal herbs has increased scientific scrutiny of their therapeutic potential and safety. Number of researchers has made attempts to provide scientific backing to the traditional claims of the plants. *EH* has been found to have tremendous pharmacological potential. Researchers have tested this plant for antibacterial, anti-inflammatory, analgesic, anti-pyretic, antihistaminic, anti-diabetic, anti-anemic, immuno-bioactivities and antioxidant activities etc.

#### **Antibacterial activity**

*E. hirta* extracted using the chloroform, methanol, acetone, and ethanol are used in saponification procedure. The efficacy of the extracts on the uropathogens were tested by agar disc diffusion method in order to analyse the inhibitory activity of plant extract on the microorganisms. *Euphorbia hirta* Linn. exhibited high inhibitory activity against most of the 11 tested pathogens. Among the tested organisms, *Pseudomonas aeruginosa* and *Staphylococcus epidermidis* were the most susceptible, and *Serratia marcescens*, *Enterobacter cloacae*, *Citrobacter koseri*, and *Citrobacter freundii* were the least inhibited by most of the extracts of *E. hirta*. It is concluded that revised antibiotic policies and more importantly the development of herbal medicines as an alternative may be incorporated in urological practice.<sup>10</sup>

#### **Anti diabetic activity**

Oral administration of *E. hirta* leaves extract (300 mg/kg b.w./rat/day) for a period of 30 days indicated the antidiabetic nature of the leaves extract. On the basis of determination of the lipid peroxides, hydroperoxides, and both enzymatic and non-enzymatic antioxidants evidenced the antioxidant potential of the leaves extract.<sup>11</sup>

#### **Nephroprotective activity**

The nephroprotective activity of the ethanol extract of *E. hirta* (400 mg/kg body weight) was studied in nitrobenzene-induced albino rats (1000 mg/kg body weight). The activities of antioxidant enzymes superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione-S-transferase (GST), and the levels of reduced glutathione (GSH), total thiols and vitamin-C in the kidney tissues were determined. Histopathologic investigation was

performed in the kidney tissue samples. The results indicate that the ethanol extract of *E. hirta* ameliorates renal dysfunction and could be used as an effective protector against nitrobenzene-induced nephrotoxicity, primarily through its antioxidant capacity.<sup>12</sup>

#### **Enzymes inhibition activity**

Methanolic extracts were used for their Glutathione-S-transferase (GST), Acetylcholinesterase (AChE), Carboxylesterase (CES) and Xanthine Oxidase (XO) inhibitory activities at concentration of 100 µg/ mL.<sup>13</sup>

#### **Antioxidant activity**

The leaves extract exhibited a maximum DPPH scavenging activity of (72.96±0.78) % followed by the flowers, roots and stems whose scavenging activities were (52.45±0.66)%, (48.59±0.97)%, and (44.42±0.94)% respectively. The standard butylated hydroxytoluene (BHT) was (75.13±0.75) %. The IC (50) for leaves, flowers, roots, stems and BHT were 0.803, 0.972, 0.989, 1.358 and 0.794 mg/mL respectively.<sup>14</sup>

#### **Immunomodulatory Activity**

Methanolic extract of *E. hirta* shows immunomodulatory activity, which has been proved using simple techniques like the macrophage activity testing, carbon clearance test and mast cell de granulation assay.<sup>15</sup>

#### **Molluscicides activity**

*Euphorbia hirta* Linn latex powder were evaluated against the freshwater snails *Lymnaea* (*Radix acuminata*) and *Indoplanorbis exustus* in pond. These combinations showed significant time and dose dependent effect against both the snails.<sup>16</sup>

#### **Anti cytotoxicity activity**

The alcoholic extract of *E. hirta* shows protective effect of against antitubercular drug-induced cytotoxicity in freshly isolated hepatocytes. It normalized the levels of a spartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), lactate dehydrogenase (LDH), triacylglycerol (TAG), cholesterol, total protein, albumin, total and direct bilirubin, which were altered due to anti-tubercular drug intoxication.<sup>17</sup>

#### **Antidote activity**

Fish poisoning (CFP) is an illness caused by eating tropical coral fish contaminated with



ciguatoxins (CTXs). The clinical management of patients with CFP is generally supportive. Ciguatera is asymptomatic in nature as no antidote exists, methanolic extract of *E. hirta* has shown protective effect against Ciguatera fish poisoning.<sup>18</sup>

#### **Antifungal activity**

Methanolic extracts of *Euphorbia hirta* leaves, flowers, stems and roots were evaluated against the yeast using the agar disc diffusion method; one yeast (*Candida albicans*) was screened. Inhibition zones ranged 16-29mm. Leaves extract inhibited the growth of yeast with large zones of inhibition, followed by that of flowers indicating its fungicidal activity.<sup>19</sup>

#### **Anthelmintic activity**

Ethanollic extracts of *E. hirta* were assessed for their in vitro anthelmintic activity by using the bovine filarial parasite *Onchocerca ochengi* and the free living nematode *Caenorhabditis elegans*, a model organism for research on nematode parasites. Worms were incubated in the presence of different concentrations of extracts and inhibitory effects were monitored at different time points. Ethanollic extract of *E. hirta* affected the growth and survival of *C. elegans* and *O. ochengi* significantly.<sup>20</sup>

#### **Anti anxiety activity**

Hydro-alcoholic extract of *Euphorbia hirta* (EH) shows anxiolytic property in chronically stressed rats subjected to elevated plus maze (EPM) and open field test (OFT). Treatment with EH (200 mg/kg orally for seven days) showed marked anti-anxiety activity in chronic immobilization stress. In contrast, the forced swim stress-induced anxiety was only partially decreased by *EH*. Co-treatment of rats with flumazenil at the dose of 0.5 mg/kg, Intraperitoneally(i.p), bicuculline (1 mg/kg, i.p.) or picrotoxin (1 mg/kg, i.p.) resulted in a significant reduction of anxiolytic effect of *EH* indicating that its actions are mediated through GABA(A) receptor-benzodiazepine receptor-Cl (-) channel complex.<sup>21</sup>

#### **Anti inflammatory activity**

The ethanollic extract of *Euphorbia hirta* L. (EH) shows anti-inflammatory action on lipopolysaccharide (LPS) induced inflammation. The ethanollic extract of *Euphorbia hirta* L. (EH) and its active component were studied in

lipopolysaccharide (LPS)-activated macrophage cells (RAW 264.7) as an established inflammation model. After activation, nitric oxide (NO) production and expression of iNOS protein and iNOS mRNA were measured by using a colorimetric assay (Griess reagent), western blotting, and reverse transcription polymerase chain reaction (RT-PCR), respectively. The alteration in the content of PGE (2), TNF-alpha, and IL-6 was concurrently monitored by ELISA. In results, we found that in the concentration range without showing cytotoxicity, *EH* produced a remarkable anti-inflammatory effect via its active component of beta-amyrin and showed a dose-related inhibition of LPS-induced NO production.<sup>22</sup>

#### **Antimutagenic activity**

Aqueous and methanolic extracts of *Euphorbia hirta* shows anti mutagenic activity in the Ames test utilising the mutant *Salmonella typhimurium* TA98 and TA100 strains. Quercetin (25 microg/mL) was found to be strongly mutagenic in *Salmonella typhimurium* TA98 in the absence and presence of S-9 metabolic activation. However, both the aqueous and methanol extracts did not demonstrate any mutagenic properties when tested with *Salmonella typhimurium* TA98 and TA100 strains at concentrations up to 100 microg/mL in the absence and presence of S-9 metabolic activation.<sup>23</sup>

#### **Antiviral activity**

Aqueous extract of *E. hirta* shows antiviral activity. Direct effects of the aqueous extract on HIV-1, HIV-2 and SIV (mac251) reverse transcriptase (RT) activity were determined. A dose-dependent inhibition of RT activity was observed for all three viruses.<sup>24</sup>

#### **Anti arthritics activity**

Water extracts of *Euphorbia hirta* at low doses shows beneficial in reducing cartilage degeneration in cases of arthritis.<sup>25</sup>

#### **Larvicidal activity**

Ethyl acetate, butanol, and petroleum ether extracts *Euphorbia hirta*, were tested against the early fourth instars larvae of *Aedes aegypti* L. and *Culex quinquefasciatus* (Say). The larval mortality was observed after 24h of exposure. However, the highest larval mortality was found in petroleum ether extract against *A. aegypti* and against *C. quinquefasciatus* of the

various ratios tested. This is an ideal ecofriendly approach for the control of the dengue vector, *A. aegypti* and the lymphatic filariasis vector, *C. quinquefasciatus*.<sup>26</sup>

#### **Anti Helicobacter pylori activity**

Methanol plant extracts *Euphorbia hirta* tested demonstrated anti-Helicobacter pylori activity by antimicrobial activity with zone diameters of inhibition ranging from 0-30mm. These extract shows very potent antibacterial activity on the isolates *H. pylori*.<sup>27</sup>

#### **Anti-anaphylactic activity**

Ethanol extract (EH A001) of *Euphorbia hirta* was found to possess a prominent anti-anaphylactic activity. A preventive effect of EH-A001 given by oral route at dose from 100 to 1000 mg/kg was observed against compound 48/80-induced systemic anaphylaxis. At the same range of dose, EH-A001 inhibited passive cutaneous anaphylaxis (PCA) in rat and active paw anaphylaxis in mice. A suppressive effect of EH-A001 was observed on the release of TNF-alpha and IL-6 from anti-DNP-HSA activated rat peritoneal mast cells.<sup>28</sup>

#### **Anti microbial activity**

The ethanolic extracts of the, aerial parts of *Euphorbia hirta* were tested for antimicrobial activity. This plant exhibited a broad spectrum of antimicrobial activity, particularly against *Escherichia coli* (uropathogen), *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.<sup>29</sup>

#### **Anti diarrheal activity**

The aqueous leaf extract of *Euphorbia hirta* decreased the gastrointestinal motility in normal rats and decreased the effect of castor oil-induced diarrhea in mice.<sup>30</sup>

#### **Anti malarial activity**

Ethanol extracts *Euphorbia hirta* whole plant showed anti-plasmodial activity which may be related to the presence of terpenes, steroids, coumarins, flavonoids, phenolic acids, lignans, xanthenes and anthraquinones. EtOH and CH<sub>2</sub>Cl<sub>2</sub> *E. hirta* used in Congolese traditional medicine for the treatment of malaria were submitted to a pharmacological test in order to evaluate their effect on *P. falciparum* growth in vitro of these plant species, 14 (70%) extracts including EtOH and CH<sub>2</sub>Cl<sub>2</sub> from *Euphorbia hirta* whole

plant produced more than 60% inhibition of the parasite growth in vitro at a test concentration of 6 microg/ml. Extracts from *E. hirta* showed a significant chemo suppression of parasitaemia in mice infected with *P. berghei* at orally given doses of 100-400 mg/kg per day.<sup>30</sup>

#### **Antifertility activity**

The aqueous crude extracts of *E. hirta* were administered to thirty eight-week old sexually mature male albino to determine the effects of these extracts on the male reproductive organs of these animals. The results from this study revealed that the aqueous crude extracts of *E. hirta* caused varying degrees of testicular degeneration as well as reduction in the mean somniferous tubular diameter (STD) in the treated rats. Thus, it shows that the aqueous crude extracts of *E. hirta* have potentially deleterious effects on the testes and accessory organs of rat's cause's infertility.<sup>3</sup>

#### **Anti amoebic activity**

Three major extracts from some traditional preparations, based on medicinal plants, used as antidiarrhoeal agents were investigated for their putative anti amoebic and spasmolytic activities in vitro. Results indicated that both biological activities are concentrated in the polyphenolic fraction, and not in the saponin or alkaloid containing fractions. The most active polyphenolic extracts were those from *Euphorbia hirta* whole plant inhibiting *Entamoeba histolytica* growth with MAC < 10 micrograms/ml. The same extracts, at a concentration of 80 micrograms/ml in an organ bath, also exhibited more than 70% inhibition of acetylcholine and/or KCl solution-induced contractions on isolated guinea-pig ileum.<sup>7</sup>

#### **Diuretics activity**

The water and ethanolic extracts (50 and 100 mg/kg) of the plant produced time-dependent increase in urine output. The water extract increased the urine excretion of Na<sup>+</sup>, K<sup>+</sup> and HCO<sub>3</sub><sup>-</sup>. In contrast, the ethanol extract increased the excretion of HCO<sub>3</sub><sup>-</sup> decreased the loss of K<sup>+</sup> and had little effect on renal removal of Na<sup>+</sup>. Acetazolamide, like the water extract, increased urine output and enhanced the excretion of Na<sup>+</sup>, K<sup>+</sup> and HCO<sub>3</sub><sup>-</sup>. The high-ceiling diuretic, furosemide, increased the renal excretion of Na<sup>+</sup> and Cl<sup>-</sup>; but had no effect on K<sup>+</sup> and HCO<sub>3</sub><sup>-</sup> loss. This study suggests that the active component(s) in the water extract of *E. hirta* leaf had similar diuretic spectrum to that of acetazolamide.<sup>32</sup>

### **Analgesic and antipyretic activity**

Lyophilized aqueous extract of *Euphorbia hirta* L. from the doses of 20, 25 mg/kg shows analgesic action against chemical (writhing test) and thermic (hot plate test) stimuli and anti pyretic action and antipyretic activity was obtained at the sedative doses of 100 and 400 mg/kg, on the yeast-induced hyperthermia in rat and mice.<sup>2</sup>

### **Antiasthmatic activity**

*E. hirta* is reported to have an anti-asthmatic activity due to the relaxation effect on the bronchial tubes and a depressant action on respiration.<sup>33</sup>

### **Galactogenic activity**

The powdered *E. hirta* showed a galactogenic activity in guinea pigs before puberty by increasing the secondary sexual organ and induction of milk secretion.<sup>34</sup>

### **Repellent and antifeedant activity**

The ethanolic extracts of *Euphorbia hirta* present the repellent and anti-feedant effect. The anti-feedant rates of diamondback moth (DBM) *Plutella xylostella* larvae were all more than 80%.<sup>35</sup>

### **Immunostimulant activity**

The present study was undertaken to improve the immune power of *Cyprinus carpio* by using *Euphorbia hirta* plant leaf extract used as immunostimulants. The haematological, immunological and enzymatic studies were conducted on the medicated fish infected with *Aeromonas hydrophila* pathogen. The results obtained from the haematological studies show that the RBC count, WBC count and haemoglobin content were increased in the infected fish at higher concentration of leaf extract. The feeds with leaf extract of *Euphorbia hirta* were able to stimulate the specific immune response by increasing the titre value of antibody. It was able to stimulate the antibody production only up to the 5th day, when fed with higher concentrations of (25 g and 50 g) plant leaf extract.<sup>36</sup>

### **Anticancer activity**

Another study reported the chemical composition, antioxidant, anti-inflammatory and anticancer activities of *Euphorbia hirta* L. extract. The antioxidant activities of whole *E. hirta* ethanol extract were determined by electron spin

resonance spectrophotometric analysis of 1,1-diphenyl-2-picryl-hydrazyl (DPPH), hydroxyl, and alkyl radical levels and by using an online high-performance liquid chromatography (HPLC)-2, 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) assay. The *E. hirta* ethanol extract (0.5 mg/mL) exhibited DPPH-scavenging activity of 61.19% ± 0.22%, while the positive control (0.5 mg/mL ascorbic acid) had 100% ± 0.22% activity. The concentration of the extract required to trap 50% of DPPH (IC<sub>50</sub>) was 0.205 mg/mL. Online HPLC analysis of the extract also showed strong antioxidant activity. The anti-inflammatory activity of the *E. hirta* extract was assessed in lipopolysaccharide-induced RAW 264.7 macrophages. The anti-inflammatory activity was highest in the presence of 200 µg/mL *E. hirta* extract, and nitric oxide production was decreased significantly (p < 0.05). The extract also showed selective anticancer activity at a concentration of 100 µg/mL (p < 0.05). These results indicated that *E. hirta* may warrant further investigation for the development of antioxidant, anti-inflammatory, and anticancer herbal medications.<sup>37</sup>

### **PHYTOCHEMISTRY**

*E. hirta* has been studied by various workers and a number of active constituents have been isolated. Afzelin, quercitrin and myricitrin have been isolated from the methanolic extract of *E. hirta*.<sup>40</sup> The chemical investigation of *E. hirta* has led to the isolation of rutin, quercitrin euphorbin-A, euphorbin-B, euphorbin-C, euphorbin-D, 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.<sup>13,14</sup> *E. hirta* also contains β-amyrin, 24-methylenecycloartenol, β-sitosterol, heptacosane,<sup>1</sup> shikmic acid, tinyatoxin, choline, camphol, and quercitol derivatives containing rhamnose and chtolphenolic acid.<sup>4</sup>

### **CONCLUSION**

Review of the literature reveals that different parts of the plant *EH* have variety of medicinal applications which attract the attention of many scientists to screen this plant on the scientific basis to disclose it as a potent medicinal agent. Several pharmacological studies have been carried out with extract of the plant. Since the compounds



from the natural sources are safe for use, the need is to isolate potent chemical constituents from the plant and to carry out pharmacological screening in search of safe and useful drug.

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