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A Review on pharmacological potential of *Euphorbia hirta Linn.*

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ABSTRACT

Euphorbia hirta (sometimes called asthma-plant[3]) is a pantropical weed, originating from the tropical regions of the Americas.[4] It is a hairy herb that grows in open grasslands, roadsides and pathways. It is widely used in traditional herbal medicine across many cultures, particularly for asthma, skin ailments, and hypertension.[5] It is also consumed in herbal tea form as folk medicine for fevers in the Philippines (where it is known as tawa-tawa), particularly for dengue fever and malaria

KEYWORDS- Euphorbia hirta , weed, herbal, hypertension, folk, medicine

1. INTRODUCTION

This erect or prostrate annual herb can grow up to 60 cm (24 in) long with a solid stem that is furnished with many yellow to reddish coarse hairs, and produces an abundant white latex.[8] There are stipules present. The leaves have an oblique base and are simple, elliptical to slightly rhombic, hairy (on both upper and lower surfaces but particularly on the veins on the lower leaf surface), with a finely dentate margin, the veins upperside being deep-set and conspicuous on the underside, and the leaf surface somewhat leathery. Leaves occur in opposite pairs on the stem. The flowers are unisexual and found in axillary cymes at each leaf node, held as dense balls of flowers and fruit capsules usually close to the stem, the flower glands with tiny white/pinkish petal-like appendages. The fruit is a capsule with three valves (creating 3 sides), uniformly appressed hairy, containing tiny (0.7–0.9 mm), oblong, four-sided orange to pink or red seeds. It has a white or brown taproot. [1,2,3]

The oldest remedies known to mankind are herbal medicines. India is known worldwide for its Ayurvedic treatment. Euphorbia hirta is often used traditionally for female disorders, respiratory ailments (cough, coryza, bronchitis, and asthma), worm infestations in children, dysentery, jaundice, pimples, gonorrhea, digestive problems, and tumors. It is reported to contain alkanes, triterpenes, phytosterols, tannins, polyphenols, and flavanoids.

E. hirta is used in the treatment of gastrointestinal disorders (diarrhea, dysentery, intestinal parasitosis, etc.), bronchial and respiratory diseases (asthma, bronchitis, hay fever, etc.), 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.[3]

Extracts of *E. hirta* have been found to show anticancer activity. The aqueous extract of the herb strongly reduced the release of prostaglandins I2,E2, and, D2[3] The aqueous extract also inhibits aflatoxin contamination in rice, wheat, maize, and mustard crops.[7] 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 exudate exhibits nematicidal activity against juveniles of meloidogyne incognita.[3]

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.[1] The polyphenolic extract of *E. hirta* has antiamoebic[8] and antispasmodic activity.[9] Quercitrin, a flavanoid glycoside, isolated from the herb showed an antidiarrheal activity.[10–11] It is reported to have a relaxation effect on respiration.[12] The alcoholic extract of whole plant shows hypoglycemic activity in rats.[6] It has a sedative effect on the genitor-urinary tract.[4] *E. hirta* has been studied by various workers and a number of active constituents have been isolated. Afzelin (I), quercitrin (II), and myricitrin (III) have been isolated from the methanolic extract of *E. hirta*.[13] 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.[14–15] *E. hirta* also contains β-amyrin, 24-methylenecycloartenol, β-sitosterol, heptacosane, nnonacosane,[1] shikmic acid, tinyatoxin, choline, camphol, and quercitol derivatives containing rhamnose and chtolphenolic acid[4,5,6]

2. RESULTS

PHARMACOLOGICAL ACTIVITIES

Antibacterial activity

The ethanolic extract of *E. hirta* inhibited the growth of the Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, and Bacillus subtili[16] and aqueous and chloroform leaf extracts of *E. hirta* possess an antibacterial activity against Klebsiella pneumonia. The extract is noncytotoxic and antibacterial.[17]

Antimalarial activity

The bioassay-guided fractionation of the methanolic extract of aerial parts of *E. hirta*, monitored against P. falciparum parasites, yielded a main active chromatographic fraction showing 90% growth inhibition of P. falciparum at a concentration of 5 μg/ml.[13]

Anti-inflammatory activity

The n-hexane extract of aerial parts of *E. hirta* showed anti-inflammatory effects in the model of phorbol acetate-induced ear inflammation in mice. It exhibited a dose-dependent effect.[18,19]

Galactogenic activity

The powdered *E. hirta* showed a galactogenic activity in guinea pigs before puberty by increasing the development of the mammary glands and induction of secretion.[20]

Antiasthmatic activity

E. hirta is reported to have an antiasthmatic activity due to the relaxation effect on the bronchial tubes and a depressant action on respiration.[12]

Effect on urine output and electrolytes

Ethanolic and aqueous leaf extracts of *E. hirta* significantly induced diuresis in rats. The diuretic effect of the ethanol extract was significant at 6 h (for 100 mg/kg) and at 24 h (for 50 mg/kg). The water extract induced a significant increase in urine Na+, K+ and HCO3- loss. The ethanol extract (100 mg/ml) caused a significant decrease in the K+ loss whereas the water extract increased its excretion. The HCO3- urine output following the injection of both extracts was tremendously enhanced.[21]

Antidiarrheal activity

The antidiarrheal effect of the herb decoction was studied in mice. It demonstrated an activity in models of diarrhea induced by castor oil, arachidonic acid, and prostaglandin E2.[10] Quercitrin, a flavanoid glycoside isolated from *E. hirta*, showed an antidiarrheal activity, at a dose of 50 mg/kg, against castor oil and prostaglandin E2-induced diarrhea in mice.[11]

Antioxidant activity

The aqueous extract of *E. hirta* L. showed an antioxidant effect and a free radical scavenging activity in various in

vitro models like total antioxidant and total ferric reducing power determination, assay for free radical-scavenging activity using ABTS, DPPH, and hydroxyl radical scavenging assays. It showed maximum antioxidants and free radical scavenging activities, at 0.25 mg/ml. The free radical scavenging effect on DPPH and hydroxyl was found as 68.80 ± 5.21 and 73.36 ± 5.21%, respectively.[22]

Antifertility activity

E. hirta at a dose of 50 mg/kg reduced the sperm motility and density of cauda epididymal and testis sperm suspension significantly, leading to 100% infertility.[23]

Antiamoebic activity

The polyphenolic extract of *E. hirta* inhibited the growth of Entamoeba histolytica with a minimum active concentration of less than 10 μg/ml.[8]

Antifungal activity

An ethanolic extract of *E. hirta* showed an antifungal activity against plant pathogens Colletotrichum capsici, Fusarium pallidoroseum, Botryodiplodia theobromae, Phomopsis caricae-papayae, and Aspergillus niger using the paper disc diffusion technique.[24]

3. DISCUSSION

E. hirta contains afzelin, quercitrin, myricitrin, rutin, gallic acid, quercitin, euphorbin-A and ephorbin-B, euphorbin-C, euphorbin-D, β-amyrin, 24-methylenecycloartenol, β-sitosterol, heptacosane, n-nonacosane,[14,15] shikmic acid, tinyatoxin, choline, camphol, and quercitol derivatives containing rhamnose, and chtolphenolic acid.[6]

This herb shows antibacterial, anti-inflammatory, antimalarial, galactogenic, antiasthmatic, antidiarrheal, anticancer, antioxidant, antiferlity, antiamoebic, and antifungal activities. Further research is going on to find out more activities in constituents of *E. hirta*.

There are many other traditional uses of *E. hirta* in Ayurveda which serves as the basis for further studies. This review will definitely help the researchers to know its different properties.[7,8,9]

4. CONCLUSION

Flowers of *E. hirta* were collected in the month of September-October, 2008 from campus of Kurukshetra University, Kurukshetra, India and were identified at the Department of Botany, Kurukshetra University, Kurukshetra, India. A voucher specimen of the plant is preserved in the herbarium of the Faculty of Pharmaceutical Sciences, Kurukshetra University (No. IPS/KUK/E-1/2009).

The flowers were washed with water and dried in shade. The dried flowers were powdered by using dry grinder and passed through sieve. This powder was packed into soxhlet apparatus and extracted successively with petroleum ether (60-80°) and ethanol (yield 26.83 and 24.74% respectively). All the extracts were dried at 45°in rotary evaporator to produce a semisolid mass and stored in airtight containers in refrigerator below 10°.[10,11,12]

Albino mice of either sex, weighing about 30-35 g were used in the experiment. Animals were maintained under standard environmental conditions i.e. ambient temperature of 22±2 °and at 45–55% relative humidity for 12 h, each of dark and light cycle and fed with a standard pellet mice diet obtained from Ashirwad Industries, Chandigarh, India and water was supplied ad libitum. All the studies were conducted in accordance with the Animal Ethical Committee of the University.

Mice were made diabetic by a single intraperitoneal injection of freshly prepared alloxan (150 mg/kg i.p.) in sterile saline. Twelve days after alloxan injection, animals shown blood glucose level >140 mg/dl were considered as diabetic and used for the study. In the experiment, mice were divided into seven groups of six mice each.

Group I (Normal healthy control) received only vehicle (Tween 80, 5% v/v). Group II (Diabetic control) received vehicle only. In group III and IV diabetic mice received petroleum ether flower extract 250 and 500 mg/kg respectively). In group V and VI diabetic mice received ethanol flower extract (250 and 500 mg/kg respectively). Group VII was treated with glibenclamide (10 mg/kg).

The mice were given extracts for 21 days once daily by oral route using an intragastric tube. Blood glucose levels were measured using blood glucose test strips with elegance glucometer (Frankenberg, Germany) at random on initial, seventh, fourteenth, and twenty first day by taking blood samples from tail vein puncture under light ether anesthesia[10,13,14].

After blood glucose estimation on day 21, whole blood was collected by cardiac puncture under mild ether anesthesia from mice. Serum cholesterol, triglycerides, HDL, VLDL and LDL were also evaluated in normal and alloxan induced diabetic mice. The total cholesterol is

measured using diagnostic kits, Boehringer Mannheim, Germany. Total cholesterol and triglycerides were determined by the method of Rifai et al.[11] HDL was measured by the method of Burstein et al.[12] The VLDL cholesterol was calculated using the formula (TG/5) mg/dl. The serum LDL cholesterol was estimated by the method of Friedwald et al.[13,15,16,17]

Serum creatinine, urea, alkaline phosphatase and total proteins levels were also evaluated in normal and alloxan induces diabetic mice. Serum urea and creatinine were assayed by the method of Tomas,[14,15]. Total proteins[16] and alkaline phosphatase were assayed by the method of Wilkinson et al.[17]

Antioxidant activity of *E. hirta* (ethanolic flower extract) was evaluated by following methods: DPPH free radical scavenging activity[18], superoxide radical scavenging assay[19,20], nitric oxide scavenging activity[21], and reducing power assay[22].

All the values of body weight, blood glucose and biochemical estimations were expressed as mean±standard error of mean (SEM) and comparison between the groups was made by student t- test. A valve of $p < 0.001$ was considered significant.[18,19,20]

Daily treatment of flower extracts for three weeks led to a dose dependent fall in blood glucose levels. Maximum effect seems to reach after 15 days of treatment and remains constant in third week. Administration of alloxan led to elevation of blood glucose levels, which was maintained over a period of three weeks. As shown both extracts induced significant ($p<0.001$) antidiabetic effects in dose-dependent fashion when compared to the control group.[23,24]

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