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A REVIEW - TAXONOMICAL STUDY AND MEDICINAL USES OF EUPHORBIA HIRTA (LINN.) IN CHURU RAJASTHAN

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ABSTRACT

Euphorbia hirta Linn. is a common herb belonging to the family Euphorbiaceae, which is frequently seen everywhere in Rajasthan. Though almost all of its parts are used in traditional systems of medicines, aerial parts and leaves are the most important parts which are used medicinally. It is used in different systems of medicine in the treatment of diarrhoea, bronchitis, skin diseases, fever, analgesic, gastrointestinal disorders, vomiting, wound healing, respiratory diseases, pulmonary disorders etc. The plant has been used as antimicrobial, anti-inflammatory, anti-tumor, antiamoebic, antifertility, antimalarial, antioxidant, sedative, cytotoxic, aflatoxin inhibition, larvicidal, immunomodulatory and so on. The aim of current ethnopharmaceutical documentation on this medicinal plant was to pile up the enormous amount of fresh information of scientific research and reports available in different aspects that proves its involvement in pharmacology. This update review also includes reports on taxonomy, morphology, monographs, distribution, phytochemistry and traditional medicinal uses of the plant. Taxonomic study of any plant makes it easier to identify the other important plants from the same taxonomic groups.

KEYWORDS: *Euphorbia hirta*; Ethnopharmaceutical; Pharmacology; Phytochemistry; Traditional use.

INTRODUCTION

Euphorbia hirta is an annual herb 15-50cm high , erect or ascending , hispid with long often yellowish crisped hairs; stems usually terete; branches often lanceolate or obovate-lanceolate, acute or subacute, serrulate or dentate, dark green above, pale beneath , base usually unequal

sided acute or rounded. It is a common weed found throughout the hotter part of India and most of tropical and subtropical countries.[18] The juice of plant is given in dysentery and colic and its decoction is used in asthma and chronic bronchial affections. The root is given to allay vomiting and leaves of plant are useful to decrease the gastric motility, sometimes it is useful to treat the diarrhea. The white juice / latex is used by women to increase the flow of milk. The latex is also applied for conjunctivitis and for removal of thorn or other foreign body and also applied as an antidote to arrow poison. The plant is chiefly used in affections of childhood in worms bound complaints and cough. It is sometime prescribed in gonorrhea. It is also used as an astringent. Also used in genito-urinary and respiratory disorders. The plant is widely used in West Africa as a medicine. The leaves are used in curing sores. The juice is sometimes squeezed into the eyes to cure eye trouble. It is also applied topically to treat ulcers oedemas. It is consider tonic, narcotic and anti-asthmatic.[19,38] The extract of *E.hirta* has sedative effect on the mucous membrane of the respiratory and gentio-urinary tract. The plant has been also used in bowel complaints, worm infestations, kidney stones and low milk yield. The whole plant has also been reported to possess anti-bacterial,[44] anti-amoebic,[41,11] anti-fungal,[24,28] anti-viral,[43] spasmolytic,[41] anti-diarrheal,[14] sedative, anxiolytic,[10] analgesic, anti-pyretic, anti-inflammatory,[21] anti-malarial[22] and anti-hypertensive[39,16] properties.

Study Area

As we know that the area under district i.e. Churu district belongs to the State of Rajasthan, the State of Rajasthan is located in north-western India as shown in figure : 2.1. The district of Churu lies in the north-east of Rajasthan State at an altitude of 286.207 metres above the mean sea level. From geographical spread point of view has extension from 27°24' to 29° north latitudes and 73°40' to 75°41' east longitudes. It is bounded by Hanumangarh in north, Bikaner in west, Nagaur in south and Sikar, Jhunjhunu districts and boundaries of Haryana State in the east. It covers six tehsils namely: Taranagar, Rajgarh, Churu, Sardarshahr, Ratangarh and Sujangarh. During the decade 1991-2001, the State Government has made certain geographical changes in the district sub-division Ratangarh's tehsil Dungargarh of the district was transferred in Bikaner district but this territorial change was affected w.e.f. 1.4.2001, hence for the purpose of census, Dungargarh tehsil is treated as part of the Churu district but here the author for the purpose of study area i.e. Churu district, Dungargarh tehsil is not treated as part of the Churu district. The total area of Churu district consist 1354623 sq. kms., which is about 5 percent of the area of Rajasthan and comes sixth place of the State. It

is second bigger district in Bikaner division. The district is extended up to 150 kms. in east to west and 120 kms. in north to south. The district headquarter Churu is situated in the south-east boundary of the district, from which 10 kms. south-east the boundary of Jhunjhunu district is situated. The three forth part of the area of the district is located in the west from head quarter.

According the census of India (2011) Churu district covers about 2.97 percent of the total State's population. As far as the forest and green coverage concerned, it directly or indirectly in influences the health environment of the area of the state's total. The density of population of the study area very low i.e. 148 persons per square kilometre. Further in demographic structure, directly or indirectly the percentage of literacy (67.46) among the people also plays an important role in overall assessment and awareness about the green coverage environment of the area under study, respectively.

Taxonomical study of *Euphorbia hirta (Linn.)*

Kingdom: Plantae

Subkingdom: Viridaeplantae

Infrakingdom: Straptophyta

Division: Tracheophyta

Subdivision: Spermatophytina

Infradivision: Angiosperms

Class: Magnoliopsida

Superorder: Rosanae

Order: Malpighiales

Family: Euphorbiaceae

Genus: Euphorbia,

Species: *Euphorbia hirta* (*Euphorbia pilulifera*).[3]

Common names

Arabic: labeinah, Em elhaleeb, Euphorbia;

English: asthma plant, Asthuma weed, garden spurge, pill-bearing spurge, snake weed;

Hindi: Dudhi;

Indonesia: Daun Biji Kcang,

Philippines: Botobotonis;

Spanish: golondrina, hierba de boca, lecherón chico, lecherita, pichoga, yerba de sapo; **Thailand:** Nam Nom Raatchasee.[03-42]

Plant Description

Euphorbia hirta belongs to the plant family Euphorbiaceae and genus Euphorbia. 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 subacute, 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.[9,20,06,45,27,17,36]

Habitat

Euphorbia hirta is distributed throughout the hotter parts of India and also found in all region of rajasthan, often found in waste places along the roadsides.[33,20] it is a pan tropical weed and in churu district it is found especially on roadsides, railway tracks and wasteland.

Habit

Suberect or procumbent herbs, simple or branched with stems and branches yellowish or reddish, pilose, more or less flexuose, faintly striate, somewhat woody at the base, slightly thickened at the nodes.

Stem

Cylindrical, hail, often reddish. Strongly pubescent with long pluri-cell hairs, having milky sap.

Roots

Taproot letting flow white latex when it is cut.

Leaves

Elliptic, ovate, oblong-lanceolate or rhomboid-oblong, acute or sub-acute at apex, obliquely rounded at base, minutely toothed along the margins, green, at times purplish on lower surface and with black spots on upper surface, appressedly hairy, stipules green or purplish, minutely toothed, petioles terete, hairy.

Inflorescence and Flowers

Cymes collected in dense axillary or terminal clusters, sub-globose and pedicelled. Flowers small unisexual, staminate and pistillate, assembled in the same involucre which is cup-shaped, four-toothed at the top, the teeth alterning with minute glands. Flowers are greenish-yellow or at times pinkish-purple, axillary, solitary, peduncles hairy, glands 4-6, reddish, minute, with or without a minute petaloid limb, erect.

Fruit

Capsule globose, dehiscent, three-angled with three locules containing each a seed, covered with very short hairs; measuring 1,5mm in diameter.

Seeds

Red- brown, 1mm long, slightly transversally ribbed or wrinkled when dry.

Traditional uses

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.[2-30] 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 headache, toothache, rheumatism, colic, and pains during pregnancy. It was also used as an antidote and pain relief of scorpion stings and snakebites.[26] 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 in sprains and inflammation, miscarriage, epilepsy, maggots in wounds and irregular growth of teeth.[7]

Medicinal parts used: leaves, stem and flowers.

Pharmacological Activity

Anti-inflammatory activity

The n-hexane extract of the aerial parts of E. hirta and its main constituent triterpenes, β-amyrin, 24- methylenecycloartenol, and β-Sitosterol were evaluated for anti-inflammatory effects in mice. Both the extract and the triterpenes exerted significant and dosedependent anti-inflammatory activity in the model of phorbol acetate-induced ear inflammation in mice. The lyophilized aqueous extract showed analgesic, antipyretic and anti-inflammatory activity in mice and rats. A central depressant activity, expressed by a strong sedative effect associated with anxiolytic effect, was also observed.[22]

Sedative and Anxiolytic activity

Lyophilized aqueous extract of Euphorbia hirta L. (Euphorbiaceae) has been evaluated for behavioral effects in mice. Sedative properties could be confirmed with high doses (100 mg of dried plant/kg, and more), by a decrease of behavioral parameters measured in non-familiar environment tests, whereas anticonflict effects appeared at lower doses (12.5 and 25 mg of dried plant/kg), by an enhancement of behavioral parameters measured in the staircase test and in the light/dark choice situation test. These findings validate the traditional use of E. hirta as a sedative and reveal original anxiolytic properties.[21]

Anticancer activity

Cytotoxicity studies of the extracts were performed using the cell line and the non-cytotoxic concentration of the extract was tested for antibacterial activity against the cytopathic dose of the pathogen. These extracts were found to be non-cytotoxic and effective antibacterial agentsExtracts of Euphorbia hirta have been found to show selective cytotoxicity against several cancer cell lines. The plant is useful in effective treatment of cancers, particularly malignant melanomas and squamous cell carcinomas.[23]

Antidiarrhoeal activity

Forty six aqueous extracts from 38 medicinal plant species belonging to different families were selected on the basis of their traditional medicinal use as antidiarrheal agents. Only 8 plant extracts (17.39%) proved as antidiarrheal agents by a triple pronounced antibacterial, antiamoebic and antispasmodic action. They include aqueous extracts from Euphorbia hirta whole plant, leaves of Psidium guajava and Tithonia diversifolia, root bark of Alchornea

cordifolia, Heinsia pulchella, Paropsia brazzeana, Rauwolfia obscura and Voacanga Africana.[40]

Antimalarial activity

Twenty extracts including ten ethyl alcohol and ten dichloromethan from different parts of nine African medicinal plants 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 CH2Cl2 from Cassia occidentalis leaves, Cryptolepis sanguinolenta root bark, Euphorbia hirta whole plant, Garcinia kola stem bark and seeds, Morinda lucida leaves and Phyllanthus niruri whole plant produced more than 60% inhibition of the parasite growth in vitro at a test concentration g/ml. Extracts from E. hirta, C. sanguinolenta and M. morindoides showedμ of 6 a significant chemosuppression of parasitaemia in mice infected with P. berghei berghei at orally given doses of 100-400 mg/kg per day.[39]

Galactogenic activity

The powdered plant, given to female guinea pigs before puberty, increased the development of the mammary glands and induced secretion.[4]

Antifertility activity

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

Aflatoxin inhibition activity

An aqueous extract significantly inhibited aflatoxin production on rice, wheat, maize and groundnut.[32]

Anti-platelet aggregation and anti-inflammatory

Aqueous extracts of Euphorbia hirta strongly reduced the release of prostaglandins I2, E2, and D2. Additionally Euphorbia hirta extracts exerted an inhibitory effect on platelet aggregation and depressed the formation of carrageenin induced rat paw oedema. The chemical nature of the active principle of Euphorbia hirta could be characterized as (a) compound(s) of medium polarity in the molecular weight range of 1000 to 3000 Da.[13]

Immunomodulatory activity

Aqueous and aqueous-alcoholic extracts, containing flavonoids, polyphenols, sterols and terpenes, demonstrated immunostimulant activity. The aqueous extract affected lectin-induced lymphoblast transformation *in vitro.*[37]

Antifungal activity

An ethanolic extract displayed antifungal activity when tested against the plant pathogens Colletotrichum capsici, Fusarium pallidoroseum, Botryodiplodia theobromae, Alternaria alternata, Penicillium citrinum, Phomopsis caricae-papayae and Aspergillus niger using the paper disc diffusion technique.[25]

Larvicidal activity

Larvicidal activity of ethyl acetate, butanol, and petroleum ether extracts of Euphorbiaceae plants, *Euphorbia hirta*, was tested against the early fourth instar larvae of *Aedes aegypti* L. and *Culex quinquefasciatus* (Say). The larval mortality was observed after 24 h of exposure. The LC50 value of petroleum ether extract of *E. hirta*, was 272.36 ppm against *A. aegypti* and 424.94against *C. quinquefasciatus.*[29]

Antioxidant activity

Aqueous extract of *Euphorbia hirta* L. was prepared in hot water and crude extract yield (7%w/w) after lyophilization was used for antioxidant potential determination. The total antioxidant potential of crude extract was determined using phosphomolybdenum complex and ferric reducing power (FRAP) assays, which showed 185 µmol of ascorbic acid and 398 µmol Fe (II) equivalent per gram crude extract, respectively. The crude extract exhibited significant free radical scavenging activity of 247 µmol Trolox equivalent per gram crude extract.[31]

Serum biochemistry

The effects of the chromatographic fractions of *Euphorbia hirta* Linn were administered to rats in graded doses of 400mg/kg, 800mg/kg and 1600mg/kg orally for fourteen days. After fourteen days the serum biochemical parameters total protein, albumin, globulin, alanine aminotransferase (ALT), alkaline phosphatase (ALP), aspartate aminotransferase (AST), total bilirubin, creatinine, and blood urea nitrogen (BUN) significant increase in rats.[34]

Anti-anaphylactic activity

The Euphorbia hirta ethanolic extract (EH A001) 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-α and IL-6 from anti-DNP-HAS activated rat peritoneal mast cells.[46]

Anthelmintic activity

The anthelmintic efficacy of the aqueous crude extract of *Euphorbia hirta* Linn was studied in 20 Nigerian dogs that were naturally infected with nematodes. Results of this study show that the aqueous crude extracts of *E. hirta* after its administration into local dogs produced a significant increase ($P< 0.05$) in PCV, RBC, Hb conc., TWBC and lymphocyte counts. The faecal egg counts also showed a remarkable and significant reduction in the levels of the identified helminthes.[8]

Antidiarrhoeal activity

The aqueous leaf extract of *E.hirta* significantly decrease the gastrointestinal motility and decrease the effect of castor oil induced diarrhea. These findings may lend support to the traditional use of *E.hirta* in diarrhea. It is also focused that the leaves of this plant possibly play a vital role in anti- diarrhoeic activity of the whole plant as reported earlier.[14]

Diuretic Activity

The leaves extract of *E.hirta* increase the urine output and enhance the excretion of electrolytes i.e. Na+, K+, HCO3 - . The water and ethanol extracts of the plant produced time dependant increases in urine output. Electrolyte excretion was also significantly affected by the plant extracts. The water extract increase the urine excretion of Na+, K+ and HCO3 - . In contrast the ethanol extract increased the excretion of HCO3 -, decreased the loss of K+ and had little effect on renal removal of Na+. Acetazolamide, like the water extract, increased the urine output and enhance the excretion of Na+, K+ and HCO3 - . The high – ceiling diuretic, furosemide, increased the renal excretion of Na+, and Cl-; but had no effect on K+ and HCO3 - loss. These results validate the traditional use of *E.hita* as a diuretic agent.[16]

Antimicrobial activity

The ethanolic extract of aerial parts of *E.hirta* was tested for anti-microbial activity along with the ethanolic extracts of dry fruits of *Caesalpinia pulcherrima* and flowers of *Asystasia gangeticum*. The three plants exhibited a broad spectrum of anti-microbial activity particularly against *Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa* and *Staphylococcus aureus.*[35]

Molluscicidal activity

The aqueous and serially purified latex extracts of *E.hirta* have potent molluscicidal activity. Sub lethal doses of aqueous and partially purified latex extracts of plant also significantly alter the levels of total protein, total free amino acid, nucleic acid and the activity of enzyme protease and alkaline phosphatase in nervous tissue of the snail *Lymnaea acuminate* in time and dose dependant manner. This is toxic effect of stem bark and leaf extract of *Euphorbia hirta.*[08]

Antibacterial activity

The methanolic extract of *E.hirta* possesses the anti-bacterial activity along with compounds extracted from *Camellia sinensis* were studied against dysentery causing *Shigella* species using the Vero cell line. These extracts were found to be non-cytotoxic and effective anti-bacterial agent.[1]

Wound healing activity

The ethanolic extract of whole plant of *E.hirta* possesses significant wound healing activity. The histopathological study, W.B.C. count and haemostatic activity were carried out to support its wound healing activity. The ethanolic extract of *E.hirta* has promoted wound healing activity and probable mechanism may the promotion of collagen biosynthesis which further supports for increase in tensile strength of the granulloma tissue. This evidence supports the use of *E.hirta* in the management of wounds.[15]

Antihepatoxic activity

The antihepatotoxic effect of *Euphorbia hirta* and *Boerhaavia diffusa* extracts were evaluated in experimental models of liver injury in rats induced by CCL4 or paracetamol. Hydroalcoholic extract (HE) from whole plant were tested.The Hepatic dysfunction was accessed by determining different biochemical parameters in serum and tissues. In serum, the activities of enzymes like Aspartate Aminotransferase (AST), Alanine aminotransferase

(ALT), alkaline phosphatase (ALP), alkaline phosphate (ALP), Bilirubin were evaluated. Lipid peroxidation and reduced glutathione were also measured into control and treated rats. *E.hirta* whole plant (HE) showed hepatoprotective activities at doses 125 mg/kg and 250 mg/kg, since serum levels of ALT and AST in rats given the extracts were significantly low ($p<0.05$ and 0.01 respectively) When compare to control CCL4 or paracetamol-injured rats. Furthered studies were carried on the HE from the whole part of both the plant by using the combination of the extract showed the highest level of antihepatotoxic activity with the hydroalcoholic extract which was effective at doses 75mg/kg and 150 mg/kg, for hepatoprotective activity in CCL4 and paracetamolinjured rats. In experiments comparing the comprising the HE (125- 250 and 75- 150 mg/kg) to reference antihepatotoxic substance (silymarin) the HE exhibited a 70 and 80% hepatoprotection compared to the 80 and 90% one exhibited by silymarin in CCL4 or paracetamol -injured rats respectively. This study demonstrated that hydroalcoholic extract *Euphorbia hirta* and *Boerhaavia diffusa* was effective in protecting the liver from toxic hepatitis.[5]

Antiviral activity

The antiretroviral activities of extracts of Euphorbia hirta were investigated in vitro on the MT4 human T lymphocyte cell line. The cytotoxicities of the extracts were tested by means of the MTT cell proliferation assay, and then the direct effects of the aqueous extract on HIV-1, HIV-2 and SIV (mac251) reverse transcriptase (RT) activity were determined. A dosedependent inhibition of RT activity was observed for all three viruses. The HIV-1 inhibitory potency of E. hirta was studied further, and the activities of the aqueous and 50% methanolic extracts were compared. The 50% methanolic extract was found to exert a higher antiretroviral effect than that of the aqueous extract. The 50% MeOH extract was subjected to liquid-liquid partition with dichloromethane, ethyl acetate and water. Only the remaining aqueous phase exhibited significant antiviral activity; all the lipophilic extracts appeared to be inactive. After removal of the tannins from the aqueous extract, the viral replication inhibitory effect was markedly decreased, and it was therefore concluded that tannins are most probably responsible for the high antiretroviral activity.[12]

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