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Review Article

Eclipta alba (L.): AN OVERVIEW

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Abstract: *Eclipta alba* (L.) commonly known as bhringraj as well as false daisy, is a species of plant in the family Asteraceae. It is a weed which grows in tropical and subtropical regions all over the world. It is widely dispersed throughout India, Brazil, Thailand, and China. Vernacular names of the plant include bhangaara (Hindi), maakaa (Marathi), bhangaro (Guajarati), kesuriya (Bengali), galagara (Telugu). *Eclipta alba* has been traditionally used in folk remedy, both Ayurveda and Siddha. The herb *Eclipta alba* contains many bioactive components such as coumestans i.e. wedelolactone and demethylwedelolactone, triterpenes, flavonoids, steroids, polypeptides, polyacetylenes and thiophene-derivatives. The plant is known to have some important pharmacological activities such as antimicrobial, antinociceptive, analgesic, antiinflammatory, antiviral, hepatoprotective, immunomodulatory activity, etc.

Keywords: Asteraceae, *Eclipta alba* (L.), Coumestans, Pharmacological.

INTRODUCTION

Conventional medicines play an important role in health services around the world. About three quarters of the world's population is dependent on different parts of medicinal plants and its extracts for wellbeing. In India, one of such well known and valuable medicinal plant is *Eclipta alba* (L.)[1]. It popularly known as "King of hairs" used in indigenous system of medicine as a hepatoprotective drug[2].

Trailing Eclipta plants can grow either prostrate (flat) or erect (upright) up to 36 inches tall. Seedling leaves are ovate to egg-shaped with short, toothed margins. Stems are reddish-purple with short, flat, up-turned hairs. Root are well developed cylindrical, grayish. Floral heads 6-8 mm in diameter, solitary, white, achene compressed and narrowly winged. Eclipta has round flowers that are green early then white with short rays[3-5]. Trailing Eclipta flower is seen in two colors white and blue. White flower tailing Eclipta is used in toxicology. The juice of the plant is used is used for nausea. There are three kinds of *Eclipta alba*, the white-flowering, the yellow-flowering, and the black-fruiting, but all three grow throughout India by marshes, rivers, and lakes or on the foothills of the Himalayas[6].

In ayurvedic medicine, the leaf extract is considered a powerful liver tonic, rejuvenative, and especially good for the hair [7-8]. In Ayurveda, the plant is considered as a rasayana for longevity and rejuvenation. Studies have shown that it has a profound antihepatotoxic activity. A complete symptomatic relief in epigastria pain, nausea and vomiting in ulcer patients has also been observed[9]. In China, as a cooling and restorative herb, this supports the mind, nerves, liver and eyes. *Eclipta alba* also has traditional external uses, like athlete foot, eczema and dermatitis, on the scalp to address hair loss and the leaves have been used in the treatment of scorpion strings. It is used as anti-venom against snakebite in China and Brazil[11].

This plant is known to have various pharmacological properties and is traditionally used in treatment of epilepsy[12]. Phytochemical studies on *Eclipta alba* discovered the presence of alkaloids like nicotine and ecliptine and bio-active steroidal alkaloids like verazine, dehydroverazine, ecliptalbine. Many hydrocarbons like ecliptal, α-formylterthienyl. Whole plant is said to have many Triterpenene like saponin, eclalbatin, along with α –amyrin and β-amyrin, ursolin acid, oleanolic acid and six new oleanane triterpene glycosides, eclalba saponins I-VI were also reported to be present in the whole plant[13-14].

Phytochemistry:

Eclipta alba (L.) contains wide range of active principles which includes coumestans, alkaloids, flavonoids, glycosides, triterpenoids. The leaves contain stigmasterol, β terthienylmethanol, wedelolactone, demethylwedelolactone and demethylwedelolactone-7-glucoside. The roots give hentriacontanol and heptacosanol[15]. The roots contain polyacetylene substituted thiophene. The aerial part contains phytosterol, β-amyrin in the n-hexane extract and luteolin-7-glucoside, β- glucoside of phytosterol, a glucoside of a triterpenic acid and wedelolactone. The polypeptides isolated from the plant yield cystine, glutamic acid, phenyl alanine, tyrosine and methionine

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on hydrolysis. Nicotine and nicotinic acid occur in this plant[16].

Alkaloids:

The major alkaloid was identified as (20S)(25S)-22,26-imino-cholesta-5,22(N)-dien-3β-ol (verazine, 3), while the new alkaloids were identified as 20-*epi*-3-dehydroxy-3-oxo-5,6-dihydro- 4,5 dehydroverazine (1), ecliptalbine [(20R)-20-pyridyl-cholesta-5-ene-3β,23-diol] (4), (20R)-4β-hydroxyverazine (5), 4β-hydroxyverazine (6), (20R)-25β-hydroxyverazine (7), and 25β-hydroxyverazine (8). Ecliptalbine (4), in which the 22,26-imino ring of verazine was replaced by a 3-hydroxypyridine moiety, had comparable bioactivity to verazine. Bio-active steroidal alkaloids, verazine, 20-epi-3-dehydroxy-3-oxo-5, 6-dihydro-4, 5- dehydroverazine ecliptalbine, (20R)-4s-hydroxyverazine, 4s-hydroxyverazine, (20R) 25s-hydroxyverazine and 25s-hydroxyverazine have been identified from the methanolic extract[29]. Phytochemical studies on *Eclipta alba* revealed the presence of alkaloids like ecliptine and nicotine, and bio-active steroidal alkaloids verazine, dehydroverazine ecliptalbine [17].

Coumestan:

It is an organic compound which is a derivative of coumarin. Demethylwedelolactone, isodemethyl wedelol actone, and strychnolactone can be obtained by percolation and hot extraction of *E. alba* whole plant [18]. Dried leaves of *E. alba* are source of coumarins like wedelolactone and its derivative, demethylwedelol actone, isodemethylewedelol actone and strycholactone [19].

Volatile oils:

The different types of volatile components can be isolated from the aerial parts of the plant by hydro distillation and can be analyzed by GC–MS technique. The main components include heptadecane, 6,10,14-trimethyl-2-pentadecanone, *n*-hexadecanoic acid, pentadecane, eudesma-4(14), 11-diene, phytol, octadec-9-enoic acid, 1,2-benzenedicarboxylic acid diisooctyl ester, (Z,Z)-9,12- octadecadienoic acid, (Z)-7,11-dimethyl-3- methylene-1,6,10-dodecatriene and (Z,Z,Z)-1,5,9,9-tetramethyl-1,4,7-cycloundecatriene. D-dithienyl acetylene ester[20], ecliptal or α-terthienyl aldehyde[21], α-terthienyl-methanol[22] and α-formylterthienyl [23].

Saponins:

A new triterpene saponin, named eclalbatin, together with alpha-amyrin, ursolic acid and oleanolic are isolated from the whole plant of *Eclipta alba* [24-25].

Terpenoids and their glycosides:

Taraxastane triterpene glycosides, named eclalbasaponins VII-X are found, along with four oleanane glycosides eclalbasaponins I-VI. Two oleanane-type glycosides eclalbasaponin I and eclalbasaponin II along with the ubiquitous steroid, stigmasterol were studied from an n-hexane extract of the stem bark of *Eclipta alba*. Ecliptasaponin C and D [23], new triterpenoid glucosides, have been isolated from the whole plant of *E. alba.* A new triterpenes such as α-amyrin, β- amyrin, ursolic acid, oleanolic acid, and wedelic acid has been isolated [25-26].

Sterols and Flavonoids

Sterols seen in *E. alba* are phytosterol, β-glucoside of phytosterol, daucosterol and stigmasterol-3-o-glucoside in the entire plant body[22]. Flavonoids like apigenin, luteolin and luteolin-7-glucoside[18].

Pharmacological Evaluation:

Analgesic and Anti-inflammatory activity:

The ethanol extract and the total alkaloids produce significant analgesic activity in all the different models of analgesia used. However, the total alkaloidal fraction was the most efficacious in all experimental models tested [27]. The methanolic extract administered by the oral route at a concentration of 100 and 200 $mgkg^{-1}$ showed the significant dose dependent anti-inflammatory activity in carrageenan and egg white induced hind paw oedema in rats[28].

Antimicrobial effect:

Antibacterial: It has been observed that the compounds obtained from *E alba* showed good activity against *Staphylococcus epidermidis* and *Salmonella typhimurium*[29].

Antifungal: The active compound 25-beta-hydroxyverazine showed good activity against *Candida albicans*[29]. The *in vitro* antifungal activity of *E.alba* extract was investigated against *Candida tropicalis, Rhodotorula glutinis* and *Candida albicans*[30].

Antimalarial: The anti-malarial activity of *Eclipta alba* leaves extract was evaluated against *Plasmodium berghei* ANKA strain in mice [31].

Antihyperglycemic effect: The oral administration of leaf suspension of *E. alba* for 2 months resulted in significant decrease in blood glucose, glycosylated hemoglobin HbA1c, a decrease in the activities of glucose-6 phosphatase and fructose1,6-bisphosphatase, and an increase in the activity of liver hexokinase was demonstrated[32]. *Eclipta alba* as an ingredient in polyherbal formulation Pan-five were scientifically and clinically proved to possess antidiabetic and diuretic activity by acting upon pancreas by restoration and regeneration of pancreatic β-cell activity[34].

Antioxidant properties:

Antioxidant activity of *Eclipta alba* was determined by FRAP, radical scavenging activity, reducing activity,

and DPPH assay. The antioxidant capacity was increased by increasing the concentration of the extracts. The antioxidant activity of the hexane, ethyl acetate, ethanol and water extracts of *E. alba* was determined by ferric thiocynate [33].

Hepatoprotective effect:

Eclipta alba significantly counteracted CCl_4-induced inhibition of the hepatic microsomal drug metabolizing enzymes. The loss of hepatic lysosomal acid phosphatase and alkaline phosphatase by CCl_4 was significantly restored by *Eclipta alba*. The study shows that hepatoprotective activity of *Eclipta alba* is by regulating the levels of hepatic microsomal drug metabolizing enzymes. The methanolic extract of leaves and the chloroform extract of roots of *Eclipta alba* showed significant activities in reduction of lysosomal enzyme [35-36].

Hypolipdimeic effect:

The activity of alcoholic extract of *E. alba* was assessed by studying the lipid profiles of serum, liver and heart of the control and drug-treated animals[37].Serum triacylglyceride and total cholesterol levels were significantly lower in the E50 and E100 groups and low-density lipoprotein–cholesterol levels were significantly reduced in the same groups when compared with the untreated control group[38].

Neuropharmacological effects:

The aqueous extract and the hydrolyzed fraction exhibited gastro protective effect and normalized the white blood cell count in the milk induced leukocytosis challenge model[39]. The different concentration of *E. alba* suspension was administered to rats to evaluate transfer Latency on an elevated plus maze. Mice were placed at the center of open field apparatus to assess spatial habitual learning, observed for 20 minutes for rearing and time spent during rearing using varied doses for 30 minutes, 24 hours and 96 hours and 144 hrs. The results revealed significant improvement of retrieval memory[40].

Hair growth & Alopecia:

Eclipta alba is used in hair oil preparations since it promotes hair growth and maintains hair black. Alopecia is a dermatological disorder with psychosocial implications on patients with hair loss. *Eclipta alba* is a well-known Ayurvedic herb for hair growth[41].

Effect on proteolytic and hemorrhagic activities:

Wedelolactone and demethylwedelolactone, isolated from *E. alba* demonstrated significant trypsin inhibitory effects [42]. The partially purified ethyl acetate extract of *E. prostrate* (containing 47% of wedelolactone) and wedelolactone demonstrated strong antiproteolytic and antihemorrhagic activity against Malayan Pit Viper venom in a dose dependent manner[43].

Effect on osteoblast differentiation:

Diosmetin, flavonoid and isoflavonoids, 3'*O*-methylorobol and 3'hydroxybiochanin A, isolated from the methanol extract of *E. alba* significantly increased osteoblast differentiation as assessed by the alkaline phosphatase activity[44].

Immunomodulatory activities:

It has been reported that protection of neuronal tissues may be possibly due to the immunomodulatory action of *Eclipta alba.* Therefore, *Eclipta alba* can serve as a potential memory modulator[40]. The aqueous leaf extract *Eclipta alba* was fed into a fish (tilapia, *Oreochromis mossambicus*) at different concentration as a diet for 3 weeks. After each week, non-specific humoral (lysozyme, antiprotease and complement) and cellular (myeloperoxidase content, production of reactive oxygen and nitrogen species) responses and disease resistance against *Aeromonas hydrophila* were noted which resulted in increased activity of non-specific immune parameters. The results indicate that dietary intake of *E. alba* aqueous leaf extract enhances the non-specific immune responses and disease resistance of *O. mossambicus* against *A. hydrophila*[45].

Anticancer activity:

Methanolic extract of *Eclipta alba* was estimated for its anticancer activity against Ehrlich Ascites Carcinoma (EAC) in swiss albino mice. The anticancer activity was examined by determining the tumor volume, tumor cell count, viable tumor cell count, nonviable tumor cell count, mean survival time and increase in life span in experimental animal models. The extract increased the life span of EAC treated mice and restored the hematological parameters as compared with the EAC bearing mice[46]. Coumestans are also known to act as phytoestrogens. In many countries it is used as diet which acts as chemo preventive agent in breast and prostate cancer. Dasyscyphin-C (saponins) a new isolated compound from *Eclipta alba* reported to have anticancer-cytotoxic activity [47].

Combination therapy:

Eclipta alba (whole plant), *Vitex negundo* (whole plant), *Mimosa pudica* (whole plant) and *Solanum nigrum* (aerial parts) possessed styptic and anti-inflammatory characteristics and help in rejuvenation of the vascular endothelium[48]. Combination of herbs like *Anethum sowa* (Shatapushpa), *Valeriana wallichii* (Tagar), *Piper longum* (Pippali mool), *Withania somnifera* (Ashwagandha), *Cassia fistula* (Aragvadh) and Triphala (A herbal combination of three fruits) with *Eclipta alba* (Bhringaraj) pacify the aggravated Vata dosha and combination with *Elaeocarpus ganitrus* (Rudraksha), *Herpestris monniera* (Brahmi) showed a

tranquilizer effect[49]. Herbal mixture containing *Phyllanthus nigrum, Picrorrhiza kurroa*, *Zingiber officinale*, *Boerhaavia diffusa*, *Cichorium intybus*, *Emblica officinalis*, *Andrographis paniculata, Embelia ribes*, *Terminalia chebula*, *Terminalia arjuna*, *Piper longum* with *Eclipta alba* is used as a good digestive tonic[50]. *Eclipta alba* with *Acacia catechu* leaves reduced severe hepatotoxicity[52].

CONCLUSION

Eclipta alba (L.) is a small branched herbaceous medicinal plant which offers a significant properties for treatment of various diseases. It is widely used as a drug for treatment of gastritis, jaundice, night blindness, spleen and liver enlargement, etc. The diverse range of bioactive compounds such as alkaloids, triterpenoids, coumestans, flavonoids, glycosides, etc. can be found in different parts of the plant. The pharmacological profile exhibits it to be for its good anti-microbial activity, anti-oxidant activity, anti-inflammatory activity, antitumor activity, immunostimulatory activities, hepatoprotective activity, hypolipdimeic activity, etc. In future the standardization and stabilization studies on *Eclipta alba* extract can be carried out which can help in proving it to be a promising source in neutraceutical as well as pharmaceutical industry.

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